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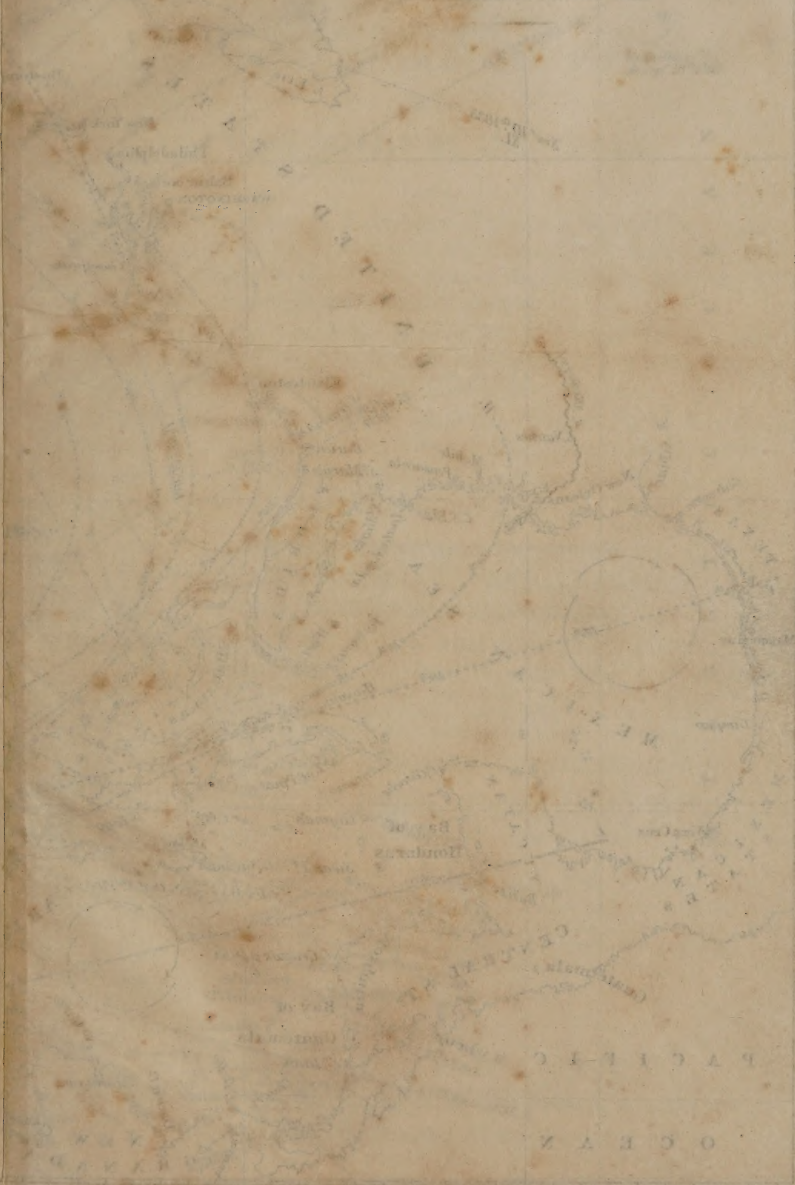
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HURRICANES

WIND REPORTS

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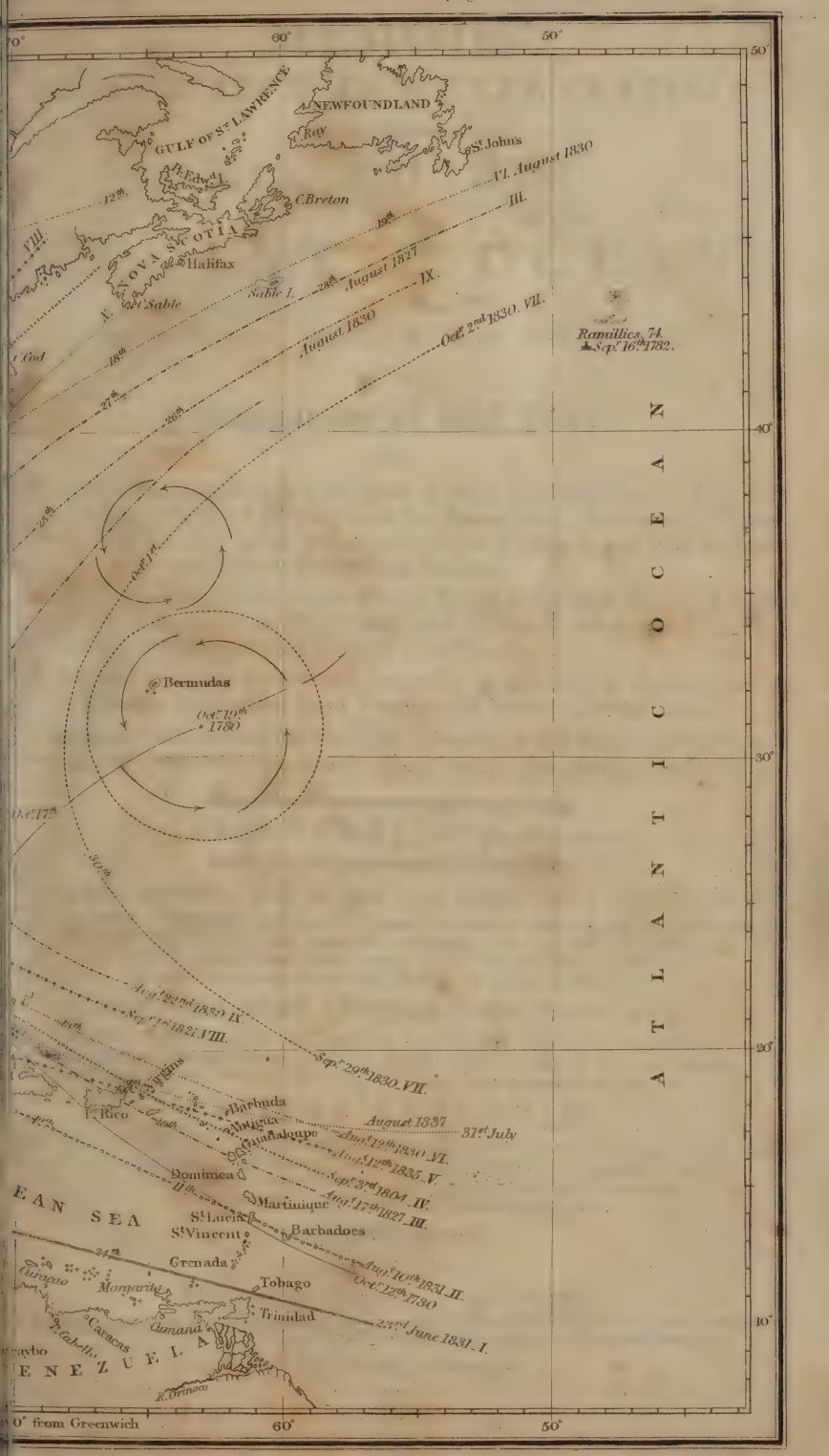
Other Observations of Storms



Courses of Various
HURRICANES.

as represented by
W^m C. REDFIELD, ESQ^R
and
Lieut. Colonel W^m Reid, R.E. C.B. &c.
since Governor of the Bermudas.





21

MEMOIR,
DESCRIPTIVE AND EXPLANATORY,
TO ACCOMPANY
THE CHARTS
Robt. Bruce
OF THE
ATLANTIC OCEAN;
Charleston AND COMPRISING *1842*
INSTRUCTIONS, GENERAL AND PARTICULAR,
FOR THE
Navigation of that Sea;

ALSO,

1. TABLES of the DETERMINED POSITIONS of all its principal Points, &c., from GREENLAND to the EQUATOR, with the Authorities; illustrated by Notes: including Remarks on the VARIATIONS of the COMPASS, and DESCRIPTIONS of the LIGHTHOUSES on the different Coasts.
2. A COPIOUS EXPLANATION of the WINDS, TIDES, CURRENTS, &c., and of the different PASSAGES over the Atlantic and Equator, as controlled by these Phænomena; including a General TIDE-TABLE.
3. DESCRIPTIONS of the COASTS and ISLANDS; particularly of AFRICA, and of the AZORES, MADEIRAS, CAPE VERDE, and BERMUDAS', ISLANDS.
4. A DESCRIPTION of ROCKS, SHOALS, ICEBERGS, and VIGIAS or SUPPOSED DANGERS; with the Authorities on which they have been inserted in the Charts.

By JOHN PURDY, HYDROGRAPHER.

EIGHTH EDITION; CORRECTED AND MATERIALLY IMPROVED:

INCLUDING, WITH NUMEROUS ADDITIONS, THOSE FORMERLY GIVEN FROM THE VOYAGES OF ADMIRAL KRUSENSTERN AND CAPTAIN LISIANSKY; OF CAPTAINS M. FLINDERS, WM. HENRY SMYTH, AND BASIL HALL, R.N.; AND OF THE BARON VON HUMBOLDT; ALSO FROM THE PAPERS OF MAJOR RENNELL,

AND FROM MANY ORIGINAL COMMUNICATIONS,

BY CAPT. AND. LIVINGSTON, CAPT. AB. BRISTOW, CAPT. JAMES WALLACE MONTEATH, J. STEELE PARK, THOS. MIDGLEY, AND T. WILSON; OTHER COMMANDERS IN THE MERCHANT-SERVICE, MR. EDW. DUNSTERVILLE, LIEUT. W. H. BRADY, R.N., &c. &c.

WITH AN APPENDIX:

Containing HINTS and REMARKS on GENERAL NAUTICAL PRACTICE; viz. a Ship's Reckoning; Latitude; Longitude; Chronometers; the Compass; Variation; Temperature of the Sea; Mode of ascertaining Currents; Meteorology; Marine Thermometer and Barometer; and the Subjects therewith connected.

LONDON:

PRINTED FOR R. H. LAURIE,

Chart-seller to the Admiralty, the Honorable Corporation of Trinity-House, &c.

NO. 53, FLEET STREET.

1840.

“ O’ER the glad waters of the dark blue Sea,
 Our thoughts as boundless, and our souls as free,
 Far as the breeze can bear, the billows foam,
 Survey our EMPIRE, and behold our HOME.”
 (Lord Byron.)

* * * The GENERAL CHARTS TO WHICH THIS WORK refers, and to which it is particularly adapted, are distinguished by having on them the mark annexed.



ERRATA, &c.

Page 9, line 4 from the bottom, 699 to be 469.

— 47, The longitude of Montreal, which has been copied incautiously from Capt. Bayfield's plan of the port and town, as $68^{\circ} 54'$, should be about $73^{\circ} 34'$.

— 183, Insert, CENTRAL DRIFT between the Cape Verde Isles and the West Indies ;—a bottle from the *Echo*, steamer, in lat. $17^{\circ} 17'$, long. $36^{\circ} 38'$, January 1, 1837 : found on the 16th of July, same year, at Half-moon Kay, on the eastern side of Antigua, having traversed in nearly a true west direction, about 1440 miles.

For the RECENT ADDITIONS to the PHARONOLOGY, or nocturnal illumination of different coasts, see page vi.

For the several Memoirs and Directories compiled by the Editor of this work, and their classification into volumes, see page xiv.

To the Binder. The chart of the Hurricanes is to be mounted on a guard, and precede the Title page.

[Entered at Stationers' Hall.]

ADDRESS.

THIS work is designed to impart to the Navigator the MEANS of SAFETY over the ATLANTIC; to develop the silent and imperceptible CAUSES of ERROR and SHIPWRECK; to point out the BEST ROUTES to the numerous Ports of this Ocean; and to communicate useful hints on GENERAL NAUTICAL PRACTICE.

Seven Editions have already been honored by the public approbation; and, stimulated by such encouragement, no attention has been spared in rendering an Eighth still more worthy of acceptance.

A comparison of the latter editions with those that preceded them, will show how much we have been indebted to numerous friends for recent and important information. We have had, again and again, to thank CAPTAIN LIVINGSTON, of Liverpool, for his numerous and valuable communications. In like manner have we been indebted to LIEUT. JOHN EVANS (*a*), R.N., and to Mr. EDWARD DUNSTERVILLE, whose information more fully appears in another work.*

To the subject of Currents, in particular, it will be found that our attention has been directed. These currents have at length excited that inquiry into their nature and causes which the importance of the subject demands. This has been especially evinced by the curious and elaborate work composed by the late MAJOR RENNELL, which has confirmed, generally, all that we had previously stated, and has, moreover, explained several essential particulars before unknown. Further investigations have been promised; so that we may expect, ultimately, an accurate view of all the *Atlantic Currents*, as they predominate in the different seasons.

We enlarge the more especially upon the Currents, because, as now treated on, they are to seamen almost a NEW SUBJECT. To the majority it is, at least, one on which they particularly require information. If this position be doubted, consult the melancholy events produced by them, which are described in the present volume, and take into consideration the incomparable number of similar cases which must necessarily have escaped our notice; and of which many have been the indubitable effects of a confidence arising from *ignorance* and *self-conceit*.†

In

* 'The COLOMBIAN NAVIGATOR,' Editions of 1839.

† The numerous wrecks that formerly occurred on the rocks and islands of Scilly, from ignorance of the tides and currents, are notorious. Add to these the wrecks, still more numerous, which have occurred on the coasts of Spain, Portugal, and Africa: upon which side of the ocean the currents have uniformly produced more mischief than on the opposite coasts. Among these were the British frigate *Apollo*, and about forty ships under her convoy, on the coast of Portugal, as described hereafter, page 171: of the vessel with M. de Brisson, in 1787, on the coast upon which, in 1810, the American ship

In presenting the former *Edition*, we had to return our thanks, for their valuable communications, to *John Mackellar*, Esq., since Rear-Admiral of the White, and to the Mercantile Captains *James Wallace Monteath*, of Liverpool, *John Wilson* and *Thomas Hamlin*, of Greenock, *Wm. J. Capes*, then of the *Lady Mackworth*, *John Steele Park*, of the *Carshalton-Park*, and *Thos. Wilson*, of the *Henry Wellesley*. To several of these gentlemen, and to Captain *George Cheveley*, we have again been obliged for important and valuable additions, now incorporated in the work.

To Lieut. *Chas. Hare*, R.N., we are indebted for the route described by him for ships bound to New Brunswick, &c. in the succeeding pages 262, 263. This route is so evidently and greatly advantageous, to every commander and merchant in that trade, as to demand particular notice. To the friendship of Mr. *Wm. Heron*, of Greenock, (since deceased,) we have been indebted for several matters of importance; among which will be found some explanation of the currents about the southern coast of Newfoundland; currents which, *while unknown*, have probably been the cause of so many wrecks on that coast.

The important communications of an accomplished officer, *Lieut. Greevelink*, late of the Dutch Royal Navy, which have added so considerably to a due knowledge of the West-Indian Seas, have been incorporated and acknowledged in the '*Colombian Navigator*;' and so much of a general nature, as the subject required, has been re-introduced in the present volume.

In the Tables of Positions and Sailing Directions, many additions have been made from the Observations and Surveys of the officers appointed to the surveying service by their Lordships of the Admiralty, as well as by other scientific men. The new documents more especially include the Memoir and Surveys of the *Baron Roussin*, of the French Navy, with those of Captains *Wm. F. Owen*, *Richard Owen*, *Edward Belcher*, *Thos. Boteler*, *Wm. Mudge*, *A. T. E. Vidal*, *John Washington*, and *H. W. Bayfield*, of the British Navy, *Major Sabine*, of the Royal Artillery, with many articles from the *Nautical Magazine*, &c., as noticed and acknowledged hereafter.

The Directors of the *Deposito Hydrografico* of Madrid have done us the honour of translating for, and inserting into, the *Derrotero de las*

Charles was wrecked, as noticed and described in our pages 173 and 295; of the *Montezuma*, page 175; of the *Eliza* and *Olymphe*, both in 1827, page 176; of the brig *Commerce*, page 296; of the *Oswego*, 299; and *Medusa*, 300: about thirty other vessels lost on the African coast, of which, according to the respectable authority of Mr. Jackson, about seventeen were English, and five American, page 295; twenty-six others wrecked on the bar of Senegal, at different times, according to M. Golberry, page 310.

Many ships, also, have been lost, by the currents, &c. on *Alleganza*, *Graciosa*, and *Santa Clara*, of the Canaries, as noticed on page 385; the *Hartwell*, East-Indiaman, on the reefs of *Bonavista*, page 400; the *Cynthia*, *George*, *Cora*, &c., on the south shore of *Barbadoes*, page 188; and, by similar causes, several others, on the *Roccas*, &c., off the Brazilian coast. See, with respect to those about Newfoundland, including the *Tweed*, the *Comus*, the *Harpooner*, the *Drake*, and the *Spence*, pages 223-4; and to these may be added the *Lady Sherbrooke*, from Londonderry to the River St. Lawrence, lost near Port au Basque, east of Cape Ray, Newfoundland, in July, 1831, when 300 persons perished!

Antillas all that we had heretofore collected on the subject of CURRENTS, and have superadded thereto some additional and valuable remarks which we have incorporated in this work. Numerous facts, of late date, illustrating the general set of currents, will be found described under their proper heads.

In the APPENDIX, also, will be found some further illustration of the same subject, with several additions on Magnetism and Chronometers, and a brief explanation of *Professor Barlow's* invaluable mode of counteracting the aberration of the compass, caused by the local attraction of the ship, &c.

The summary descriptions of all the LIGHTHOUSES on the different coasts, will, we trust, be considered as an important and useful addition; inasmuch as they will, if attended to, prevent those accidents which have so frequently happened from mistaking one light for another, examples of which will be noticed hereafter.

Our ardent wishes are, as our strenuous endeavours have been, devoted to the improvement of hydrography; and we, therefore, again, earnestly solicit communications for future correction, &c. Such communications are particularly acceptable, because ORIGINAL and AUTHENTIC; and, therefore, more to be depended upon than the imperfect statements commonly given in newspapers and other publications, as we have already had occasion to notice. The great importance of the latter has, however, been admitted; and we may here repeat the observation that, "A series of such notices, PROPERLY AUTHENTICATED, announcing the discovery and position of DANGERS, new determinations of the situations of places, &c., with the particulars of the observations, and names of the observers, would be very beneficial to the public service. Had such a measure been adopted years ago, many fine ships which, and brave sailors who, have been lost, might still have been in existence." We have urged this argument repeatedly, and have had the pleasure of seeing that, to a certain degree, the suggestion has been adopted.

The Volume lately published, entitled '*A Sailing Directory for the Ethiopic or Southern Atlantic Ocean*,' may be considered as a continuation of the present work. It describes, in a similar manner, the Islands and Dangers of that Ocean, the Coast of Africa from Sherboro' Island to the Cape of Good-Hope and Algoa Bay, and the Coasts of Brasil, &c., from the River Maranon Southward, to Cape Horn, including the Falkland Islands, South Shetland, &c.

[For the BEARINGS as given in the SAILING DIRECTIONS, see page 1.]

DURING the progress of this work, while at press, the following alterations in, and additions to, the illumination of the coasts have been made. References to this notice may, therefore, be introduced in the pages respectively annexed.

MOUTH of the THAMES.—(Page 9.)—By order of the Board of Trinity-House, a vessel has been placed near the eastern edge of the KENTISH KNOCK, which, in point of utility, may be ranked with the principal lights. It lies in latitude $51^{\circ} 39'$, long. $1^{\circ} 38\frac{1}{2}'$ E. near the spot in which a beacon-buoy formerly laid. The light is from a single lantern; it *revolves*, and burns at an elevation of 38 feet above the level of the sea. (*From the 1st of September, 1840.*)

ISLE of WIGHT. The splendid light on ST. CATHARINE'S POINT, noticed in page 9, was first displayed on the 1st of March, 1840, at an elevation of 178 feet above the level of high water. The height of the Needles light, now appearing of a red colour, is 469, not 699 feet.

COAST of FRANCE.—The new lighthouse on the HEAUX DE BRÉHAT, noticed in page 22, has been completed, and was first lighted with a brilliant fixed light, of the 1st power, on the 1st of February, 1840. The lantern is 147 feet above the level of high water spring tides, and the light may be seen at the distance of seven leagues. The tower is on the highest rock, and, according to the official notice, in latitude $48^{\circ} 54' 37''$, longitude $3^{\circ} 5' 12''$ W.

BRISTOL CHANNEL.—(Page 11.)—A new tower on the N.E. side of the entrance of the Avon, eastward of King Road, exhibiting a brilliant fixed light, at 73 feet above the level of high water, from the 25th of June, 1840.

LIVERPOOL BAY.—(Pages 11 and 268.)—The light-ship in the bay, lying as described; for the blue flag, as formerly, a large black ball is now hoisted at the main-mast head.

PORT FLEETWOOD, or WYRE HARBOUR.—(Page 11.)—At about 32 miles to the northward of Liverpool, and 8 miles S. by E. $\frac{3}{4}$ E. (magnetic) from the revolving light on Walney Island, lies the entrance of the new harbour of Wyre, now PORT FLEETWOOD, within or to the eastward of *Rossal Point*. A lighthouse, upon a new construction, supported on screw pillars, marks the western side of the channel-way into the harbour, and exhibits a brilliant fixed light, to be left on the starboard side when entering. The light is elevated 45 feet above the level of half tide, and may be seen three leagues off. A deep-sounding self-acting bell tolls 3 strokes every minute during foggy weather. (See *Nautical Magazine*, July, 1840, p. 514.)

NEW PROVIDENCE.—(Page 71.)—The lamps and lantern of the lighthouse on Hog Island, NASSAU, have been recently replaced by others, similar in construction to those of Abaco; the light being 72 feet above the level of the sea, it may now be visible, to an eye elevated 10 feet, at the distance of 12 miles; 20 feet, at $13\frac{1}{2}$ miles; and 40 feet, at $15\frac{1}{2}$ miles.

SALT KAY BANK, between CUBA and the BAHAMAS.—(Pages 73, 74.)—The British Government has established a lighthouse on the N.W. side of this bank, which was first lighted in February, 1840, and which must be highly important to the navigators of the Florida Stream. It stands on the north-westernmost and highest of the Double-headed Shot kays, in latitude $23^{\circ} 56' 28''$, and longitude (according to official notice) $80^{\circ} 27' 38''$.

The base is 46 feet above the level of high water, and the height of the tower is 54 feet; hence the light, which is brilliant and fixed, is 100 feet above the level of the sea, and is visible, to an eye elevated 10 feet, at the distance of 14 miles; 20 feet at 15 miles; 40 feet at 17 miles; and 80 feet at 20 miles.

The Light may be seen in all directions, S.W. by W. $\frac{1}{2}$ W. (magnetic) excepted, where, at the distance of nine miles, it is intercepted by Water Kay. From the lighthouse, the southwesternmost of the Double-headed Shot bears S.S.W. $\frac{1}{2}$ W. (magn.) $3\frac{1}{2}$ miles.

The Florida Stream is generally found to set strongly to the N.E., within a mile and a half of the rocks, but through the intervals of the kays, the ebb and flood tides run rapidly off and on the bank. High water, full and change, at IX h. Rise 2 to $3\frac{1}{2}$ feet. Variation 5° E. 1837.

BERBICE.—Pages 84, 86.—In February, 1840, a vessel, with a single bright light, and by day a black ball at the mast-head, was stationed off *Berbice River*, in $2\frac{3}{4}$ fathoms at low water, with the East point of the entrance bearing S.S.W. distant 10 miles. For Demerary, see p. 88.

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ADVERTISEMENT.—SAILING DIRECTORIES, &c. 1840.

IN compliance with the request of several naval friends, British and Foreign, we hereto annex a list of the several MEMOIRS and DIRECTORIES compiled, within the last forty years, by the Editor of the present work, and showing the date of the last editions, with the mode in which they may be bound in volumes, so as to form a complete set. These now comprise the navigation of all the Coasts from the ARCTIC SEAS to CAPE HORN, the CAPE OF GOOD HOPE and the Southern Coast of Africa; including the CATTEGAT, BALTIC, MEDITERRANEAN, EUXINE, and other inland seas.

VOLUME I.—1. Memoir, Descriptive and Explanatory, to accompany the General Chart of the NORTHERN OCEAN, Davis' Strait, and Baffin's Bay; including the Navigation from Great Britain and Ireland to Spitzbergen and the White Sea, inclusive, 1830. 2. Sailing Directory for the NORTH SEA, including the Eastern Coasts of England, Scotland, &c., 6th edition, 1838. 3. Sailing Directory for the Cattegat, Sound and Belts, 1833. 4. For the Baltic, 1839. 5. Gulf of Finland, 1837.

VOLUME II.—1. Sailing Directory for the English Channel, 8th edition, 1838. 2. For St. George's Channel and all the Coasts of Ireland, 4th edition, 1837.

VOLUME III.—1. Sailing Directory for the Bay of Biscay, 1839. 2. For Spain and Portugal, 1839. 3. For the Strait of Gibraltar and Western division of the Mediterranean Sea, with Additions, 1840. For the Gulf of Venice and Eastern or Levantine division of the Mediterranean Sea, together with the Sea of Marmara and the Euxine or Black Sea; 1834. Additions as above.

VOLUME IV.—Memoir, Descriptive and Explanatory, to accompany the Charts of the Atlantic Ocean, and comprising Instructions, General and Particular, for the Navigation of that Sea, with an Appendix, &c. 8th edition, 1840.

VOLUME V.—THE COLOMBIAN NAVIGATOR, or Sailing Directory for the American Coasts and the West-Indies, Vol. i. Nova Scotia to Florida and Mexican Sea, inclusive: Vol. ii. The Great Antillas, Windward Passages, and Navigation of the Gulf Stream, 1839.

VOLUME VI.—THE COLOMBIAN NAVIGATOR, Volume the third; for the Caribbee Isles, Guyana, Colombia, Mosquitia, the Bay and Gulf of Honduras, &c. 1839.

VOLUME VII.—THE NEW SAILING DIRECTORY for the Ethiopic or Southern Atlantic Ocean; comprehending the Coasts of Brasil, &c. from Maranham to Cape Horn; the Coasts of Guinea, &c. from Sierra Leon to and beyond the Cape of Good-Hope, and including the Islands between the two Coasts. 1837.

MEMOIR, &c.

* * * THROUGHOUT this work the given LONGITUDE is the LONGITUDE from GREENWICH. In the SAILING DIRECTIONS the BEARINGS and COURSES are those by COMPASS, unless where otherwise expressed : but those given thus [W.S.W.] signify the TRUE : and the given direction of Wind, Tide, and Current, is generally to be considered as the TRUE.

SECTION I. *Robt. Knox*

REMARKS *on the* CHART, *with* TABLES of DETERMINED POSITIONS, *and the* AUTHORITIES, &c. including NOTES *on the* LIGHTHOUSES and VARIATION of the COMPASS.

THE accompanying Chart, which is, we believe, the only one that exhibits the WHOLE of the Atlantic Ocean, *upon so large a scale*, has been constructed with the particular view of superseding the general use of the Chart on four sheets, distinguished by the name of M. FLEURIEU, whose observations regulated many of its important points, but which was really constructed by the late M. DE LA ROCLETTE, and originally published in the house whence the present work issues, in the year 1777.

The merits of that Chart were universally admitted ; of which, exclusive of a long continued and great demand for it, some degree of proof may arise, from its having been, during this period, more than once carelessly and coarsely copied, and illegally republished, without any attempt at amendment. Many defects in it having, however, been latterly ascertained, it has been deemed more eligible to construct a new one, founded on the improved state of hydrography, and agreeable to the most recent observations, than to amend and repair that draught.

Upon the former Chart its respected compiler observed, that, “ it is the third of the kind made public ; the first having been published some years before at Amsterdam, in four sheets, by M. Vankeulen, under the title of the *Spanish or West Indian Sea*. It contains some useful details, amidst a thousand errors ; the second, entitled *A Chart of the Atlantic Ocean*, was engraven at London, on the circular projection, invented by the late Mr. Murdoch, but was found to be extremely inaccurate, and the constructor added to the Archipelago of Cape Verde, two islands, under the names of St. Philip and St. John, neither of which existed ; these names being sometimes given by the Portuguese to the islands Fogo and Brava.” M. Rochette adds, that, “ in composing his Chart, he had many helps for the detail of the Coasts ; and that they were corrected by the best astronomic observations.”

As our present object is not to give a history of charts, we shall only add that, the determinations before made use of, which have been confirmed, have been strictly adhered to ; and later observations have been carefully compared with those which have preceded them. The result of a general comparison has been, that many positions, *rejected* by the editors of the most authentic Tables of Positions, have been retained ; while others, though subsequently given,

have been merely taken into comparison ; and a few, from their discordance, altogether rejected.

It is to the extended practice of lunar observations, and the use of chronometers, since the year 1768, that we owe our great improvements in modern Hydrography. The Geographer is happy in the consciousness of knowing that this scientific practice is now very generally understood, both in Europe and America. Chronometers in the hands of inexperienced persons, have, however, been productive of some mischief ; and may produce more, if not counteracted by vigilant attention and critical examination. Yet, while we contemplate this fact, it affords a pleasing reflection that enough has already been done, in the more important tracts of the globe, to furnish the means of comparison, and thus prevent a retrogradation. It cannot, indeed, be supposed that all who practise these methods are equally skilful and experienced ; or that, even if skilful and experienced, they can possess instruments equally correct. The most accurate observer, with an imperfect instrument, and the imperfect observer with an excellent instrument, obtain results equally erroneous. But such truths, with their consequences, are so obvious, that we hasten to the detail of authorities on which the Chart is grounded.

To the GRAND TRIGONOMETRIC or ORDNANCE SURVEY of England and Wales are owing the positions of all the points in the Southern, S.W., and Western, parts of the kingdom ; and to that of FRANCE are, in like manner, owing the equally correct positions of all the points of that country. By Captain MARTIN WHITE, and other officers employed by the British Admiralty, the Great BANK of SOUNDINGS, and the general soundings of the ENGLISH CHANNEL, have recently been taken and correctly delineated ; and they now form a most important and peculiar feature of the new charts. Superadded we have now, in the important additions of Captain A. T. E. VIDAL, 1830-1831, the great banks on the West of the British Isles, from the parallel of 52° to that of 62° N., including that of *Rokol*, which had never before been known : and, from the excellent Surveys of Captain WM. MUDGE, R.N. &c., a considerable portion of IRELAND. The coasts of SPAIN and PORTUGAL have been laid down in accordance with the valuable surveys of TOFINO, FRANZINI, &c. ; and in the delineation of the AFRICAN COASTS, with the islands off the same, we have followed the positions afforded by Messrs. FLEURIEU, VERDUN DE LA CRENNE, BORDA, PINGRE', and ROUSSIN, of France, with those of Captains BARTHOLOMEW, F. W. OWEN, VIDAL, MUDGE, BOTELER, and SABINE, and many other intelligent officers of our own country.

The AMERICAN COASTS, originally exhibited according to the observations and surveys of our illustrious countryman Captain JAMES COOK, those of Lieut. MICHAEL LANE, of Mr. Des BARRES, of Captain HOLLAND, of Messrs. WRIGHT, MASON, and DIXON, have been materially rectified by Captain BAYFIELD, Messrs. DE MAYNE, HOLBROOK, and BULLOCK, the British surveyors ; with the observations of Dr. RITTENHOUSE, Mr. ELLICOTT, and other astronomers, &c. of the United States.*

* Since the appearance of the first edition of this work, the Editor has compiled the new Map of the VICE-ROYALTY of CANADA, which includes not only the British Canadian territory, but also a considerable portion of the United States. This has afforded him an opportunity of investigating more particularly those points which he had previously considered as doubtful. The results may be seen in the succeeding Tables.

Since the appearance of the second edition, we have been favoured with a manuscript Chart of the Northern Coasts of LABRADOR and UNGAVA BAY, as explored by the missionaries of the *Unitas Fratrum*, in 1811 ; and from which our Chart of the ATLANTIC, and of the WORLD, have been corrected ; also with the positions of several important points in HUDSON'S BAY, &c., which are now given in our 'Memoir' on the Northern Ocean.

The given position of the BERMUDAS was determined by the late Captain THOMAS HURD, Hydrographer to the Admiralty, by whom these islands were surveyed, under the order of their Lordships.

For the correct delineation of the WEST-INDIA ISLANDS, much of our earlier information was derived from the labours of Messrs. PUYSEGUR, VERDUN, BORDA, PINGRE', and other foreign officers, whose names will be for ever entitled to respect. They were the pioneers who were followed by the skilful observers acting under the orders of the Hydrographic Directors of Madrid; particularly the Captains JOAQUIN FR. FIDALGO, COSME' DE CHURRUCA, and JOSE DEL RIO: to whom, and to Messrs. HUMBOLDT, OLT-MANNS, &c., we were indebted for the proximate situations of many points of SPANISH AMERICA. These have again been adjusted by British officers. JAMAICA, and the other Islands of the Colombian Sea, are exhibited according to the best topographic surveys and particular charts, and these corrected by recent observations.

We may truly add, lastly, in the language of a preceding work, that every source has been exhausted to obtain means for rendering the present one as exact as the state of geography will permit; we, therefore, now proceed to give a detailed account of each determined point, to mention the authorities, and name the observers; in short, to report all that can inspire the navigator with the confidence which we think due to it. This is done in honour to those who have made the observations; to encourage others to imitate them; and to establish the confidence of navigators in those parts of the Chart for which we have had sufficient materials, or to caution them against the few parts not yet accurately known.

The Tables which follow exhibit the Positions of Points assumed in the construction of the Draught, illustrated by Notes. They will be found highly useful in furnishing the mariner, *satisfactorily*, with his required course and distance, to a precision unattainable by the mere use of *any* General Chart; and will, also, be found a useful accompaniment to every particular Chart of the Coasts of the Atlantic extant. These Tables have been enlarged, and they now include the whole of the Irish and Western coasts.

In the Tables, we quote, in general, the principal authorities only; it should therefore be understood, that many corrections have been made on comparing such with other observations. Minute details are generally uninteresting; and this is the reason why every one is not described. In former Tables, many inaccuracies, amounting to 5, 6, and even to 15 and 20, minutes of longitude, have arisen from mere inadvertence; and many such errors exist, even to the present day, in our books of navigation, from an erroneous allowance for difference of meridians, as that of Ferro, &c., in those cases wherein the longitude has been originally given otherwise than from Greenwich. In some, the longitudes have been indiscriminately admitted from London and Greenwich, as one and the same; these, therefore, abound in errors equal to the difference. We point out such particulars with the hope that those concerned will amend them, for the general advantage of the world. Science illumines the ocean with new means of safety, and the mist of ignorance will shortly be dispelled.

It has been noticed, by more than one observer, that, when the position of a place is given, the *particular point* of it should always be *defined*, and that this point should be some object so fixed and conspicuous that it cannot be mistaken; as a castle, mole, or cathedral; many small differences having arisen from vaguely naming a town or bay. The importance of this hint will be most felt when chronometers are to be rated from a *given* longitude, and it, therefore, claims attention.

POSITIONS OF PLACES, &c.

1. ENGLAND AND WALES.

* * *The FIGURES in Parentheses refer to the NOTES subjoined to each Section.*

The DESCRIPTIONS of LIGHTHOUSES, &c. are annexed to these Notes.

	LATITUDE.	LONGITUDE.	AUTHORITIES.
	° ' "	° ' "	
GREENWICH; ROYAL OBSERVATORY*	51 28 39	0 0 0 *	The Astronomers Royal.
LONDON; Cupola of St. Paul's Church	51 30 49	0 5 47 W.	The Grand Trigonometric or Ordnance survey of England and Wales, commenced in the year 1784, by the late General Roy, F.R.S., under the direction of the Royal Society; subsequently under the orders of the Masters-general of the Ordnance; and still proceeding under the direction of Colonel Colby, of the <i>Royal Engineers</i> , F.R.S., &c.
Gravesend; Church.....	51 26 39	0 22 10 E.	
Sheerness; Flagstaff	51 26 45	0 44 26 —	
Orford; High Lighthouse ..	52 5 0	1 34 14 —	
North Foreland; Lighthouse	51 22 25	1 26 34 —	
South Foreland; High Light-house	51 8 26	1 22 6 —	
Dover Castle; the keep....	51 7 47	1 19 7 —	
Folkstone Church	51 4 47	1 10 52 —	
New Romney Church	50 59 7	0 56 22 —	
Lydd Church	50 57 7	0 54 19 —	
Dungeness Lighthouse	50 55 1	0 57 48 —	These operations, carried on in the most masterly and scientific manner, determine, with the similar triangles of France, hereafter noticed, the relative positions of all the points in the English Channel, &c.
Rye Church	50 57 1	0 44 0 —	
Beachy Head; Station in the Survey†	50 44 24	0 15 12 E.	
Brighthelmstone Church ..	50 49 32	0 7 40 W.	
Shoreham Church	50 50 0	0 16 19 —	
Selsey Church	50 45 19	0 45 41 —	
Chichester Spire.....	50 50 11	0 46 36 —	
Sea-Ower Light-vessel	50 39 57	0 39 59 —	
Portsmouth Academy.....	50 48 4	1 5 59 —	
South-Sea Castle	50 46 44	1 5 2 —	
Calshot Castle.....	50 49 7	1 18 6 —	REMARKS. * GREENWICH.—From 720 observations of the Pole Star, made during eighteen months of 1825 and 1826, the latitude of the Royal Observatory was deduced as 51° 28' 38".955. Say, as in Table, 51° 28' 39". It was formerly given 51° 28' 40". † BEACHY-HEAD. — Under the direction of the Hon. Corporation of Trinity-House, a lighthouse has been erected on Beachy-Head, and it was first lighted on the 1st of October, 1828. The light, which is powerful and revolving, burns at an elevation of about 285 feet above the level of the sea, on a spot called <i>Belle Tente</i> , being the summit of the second cliff to the westward of the Head, and exhibits its greatest brilliancy once in every two minutes. It is again noticed hereafter.
Hurst Castle	50 42 25	1 32 45 —	
Dunnose; Station in the Survey	50 37 9	1 11 36 —	
St. Catherine's Tower, Isle of Wight.....	50 35 34	1 17 51 —	
Needles' Lighthouse	50 39 54	1 33 55 —	
Christchurch Head.....	50 42 38	1 44 31 —	
Poole Church	50 42 51	1 58 55 —	
Portland Upper Lighthouse.	50 31 23	2 26 49 —	
Lyme Cobb	50 43 11	2 55 29 —	
Hob's or Bob's Nose	50 27 50	3 26 43 —	
Berry Head; Flagstaff	50 24 2	3 28 14 —	
Start Point; Flagstaff	50 13 27	3 38 21 —	
Bolt Head; Signal Station..	50 13 15	3 48 0 —	
Eddystone Lighthouse [1]..	50 10 55	4 15 3 —	
Mewstone, near Plymouth Sound	50 18 31	4 5 33 —	
Plymouth New Church	50 22 22	4 7 16 —	
Plymouth Old Church.....	50 22 15	4 7 32 —	

ENGLAND AND WALES CONTINUED.

	LATITUDE.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
St. Nicholas' or Drake's Island, Plymouth Sound [2.]	50	22	4	4	8	18	THE GRAND TRIGONOMETRIC OR ORDNANCE SURVEY of England, &c. described in the preceding page.
Meridian stone, on the Breakwater.....[2.]..				4	8	21	
Penlee Beacon	50	19	25	4	10	40	REMARKS.
Rame Head (Flagstaff)	50	18	53	4	12	29	
Dodman or Deadman Point; Flagstaff	50	13	21	4	47	4	In the public journals of 1824, it was stated that Dr. TIARKS had ascertained, in the summer of 1822, by the comparison of sixteen excellent chronometers, carried backward and forward between Greenwich and Falmouth, that the western longitude of the latter had been given at 4·4 seconds of time, or one minute and six seconds, too little, by the Trigonometric Survey. In consequence, twenty-nine of the best chronometers belonging to the Admiralty were subsequently committed to the care of the doctor, and a vessel was appointed wherein he was to sail, backward and forward, between Dover and Falmouth, until the longitude in time, between these stations, and between them and Portsmouth, as an intermediate station, was settled beyond any doubt. The result has been that, as to all places on the south coast of England, between the meridians of Greenwich and Falmouth, if one second be added to every four minutes of longitude, as given by the Survey, the exact longitude, according to the chronometers, will be obtained.
St. Anthony's Head; Flagstaff	50	8	35	4	59	31	
Pendennis Castle; Flagstaff	50	8	50	5	1	44	By reference to Note 3, it will be seen that Dr. Bradley, in 1769, gave the Lizard Point rather more than a minute westward of the longitude assigned by the Trigonometric Survey; and, by Note 5, it is shown that the same result was obtained by Captain Huddart, in the longitude of St. Agnes', Scilly. It will be sufficient for the mariner, if he assumes Pendennis Castle as 5° 2' W., the Lizard as 5° 12', St. Agnes' Lighthouse as 6° 20', &c.
St. Kivern's Steeple	50	3	7	5	4	8	
Blackhead; Flagstaff	50	1	13	5	3	59	The following places, by the Ordnance <i>corrected</i> longitudes, 1838, stand as follow :—
LIZARD Upper Lighthouse [3.]	49	57	40	5	11	5	
St. Michael's Mount	50	7	3	5	27	33	Eddystone Lighthouse .. 4 15 53 W. Lizard High Light..... 5 12 6 — St. Michael's Mount 5 28 37 — Longships Lighthouse .. 5 44 44 — Trevose Head..... 5 1 54 — Hartland Point 5 31 21 — Lundy Is. Lighthouse .. 4 40 16 — SCILLY :— St. Agnes' Lighthouse 6 20 38 — St. Mary's flagstaff... 6 18 13 — St. Martin's day mark 6 15 53 —
St. Paul's Steeple, Mount's Bay [4.]	50	5	26	5	31	37	
St. Leven's Point; Flagstaff	50	3	55	5	41	4	St. Agnes' Beacon, Cornwall
Land's End Stone	50	4	8	5	41	31	
Longships Lighthouse	50	4	4	5	43	33	Trevose Head
SCILLY ISLANDS; St. Agnes' Lighthouse, <i>revolving</i> [5.]	49	53	36	6	19	23	
—; St. Mary's;							Hartland Point
Windmill	49	54	32	6	16	59	
—; St. Mary's;							LUNDY ISLAND; Lighthouse
Flagstaff at the Fort.....	49	55	0	6	17	57	
—; St. Martin's;							Minehead Steeple.....
Day-mark.....	49	58	2	6	14	39	
St. Agnes' Beacon, Cornwall	50	18	28	5	11	56	Bridgewater Spire
Trevose Head	50	32	57	5	0	54	
Hartland Point	51	1	21	4	30	26	Bristol Cathedral
LUNDY ISLAND; Lighthouse	51	10	6	4	39	20	
Minehead Steeple.....	51	12	42	3	28	4	Flatholm Lighthouse
Bridgewater Spire	51	7	41	2	59	39	
Bristol Cathedral	51	27	6	2	35	29	Swansea Castle ..
Flatholm Lighthouse	51	22	33	3	6	25	
Swansea Castle ..	51	37	13	3	55	32	Mumbles Lighthouse ..
Mumbles Lighthouse ..	51	34	0	3	57	20	
Worms Head	51	33	56	4	18	56	Rosilly Barrow
Rosilly Barrow	51	34	35	4	15	51	
Pembrea Steeple.....	51	41	18	4	15	28	Tenby Spire
Tenby Spire	51	40	20	4	40	52	
Wool-house, Caldy Island	51	37	56	4	39	58	MILFORD Steeple.....[6.]
MILFORD Steeple.....[6.]	51	42	43	5	0	39	
Hubberstone Church	51	42	56	5	2	7	St. Anne's High Lighthouse
St. Anne's High Lighthouse	51	40	59	5	9	19	
The Islet Grasholm ..[6.]	51	43	55	5	27	32	Smalls Lighthouse ..[6.]..
Smalls Lighthouse ..[6.]..	51	43	18	5	38	54	
St. David's Cathedral.....	51	52	56	5	14	53	Ramsey Island; highest point
Ramsey Island; highest point	51	51	43	5	19	36	
Bishop and Clerks; northernmost	51	54	10	5	21	58	Cardigan Isle; highest point
Cardigan Isle; highest point	52	7	53	4	40	27	
Cardigan Steeple	52	4	59	4	38	18	Aberystwith (Station).....
Aberystwith (Station).....	52	25	49	4	3	19	
Holyhead Mountain..[7.]..	53	18	51	4	39	27	

ENGLAND AND WALES CONTINUED.

	LATITUDE.	LONG. W.	AUTHORITIES.
	° ' "	° ' "	
The West Mouse	53 25 6	4 32 13	The GRAND TRIGONOMETRIC OF ORDNANCE SURVEY of England, &c.
Amlwch Steeple	53 23 0	4 19 17	
Great Ormes Head	53 20 2	3 50 21	
Abergelé or Abergali Steeple	53 17 10	3 34 13	
Air Point Lighthouse	53 21 28	3 18 55	
Bidstone Lighthouse	53 24 6	3 3 46	
LIVERPOOL; St. Paul's Church	53 24 40	2 58 55	
Crosby Steeple	53 29 33	3 0 55	
Formby N.W. Mark	53 32 34	3 5 5	
Rossal Point Landmark	53 55 18	3 2 20	
Lancaster Steeple	54 3 8	2 47 41	REMARKS. The extraordinary changes in the approaches to the RIVER MERSEY, which occurred in the years 1838, 1839, are noticed in the Directions for pro- ceeding from and to the Ports of LIVER- POOL, &c. given as the concluding part of Section II. hereafter.
Peel Castle	54 3 49	3 9 41	
St. Bees Head; Lighthouse.	54 30 55	3 37 24	
Whitehaven; Windmill near	54 32 50	3 34 56	
Workington Chapel	54 38 34	3 33 30	
Salterness; Lighthouse	54 52 30	3 34 53	
Criffell (Station on the Sur- vey, 1831 ft. above the sea)	54 56 44	3 36 55	
ISLE OF MAN.			
North Berule (Station 1804 ft. high)	54 18 58	4 22 43	
Snea Fell (Station 2400 ft.)	54 17 28	4 26 46	

NOTES.

1. EDDYSTONE.—There are several reefs, or ridges of rock, in the vicinity of the Eddy-stone, or House Rock. Of these, the southern one extends to the distance of about 78 fathoms from the lighthouse. The East Rock lies at 65 fathoms eastward from the same, and the N.E. Rock, N. 60° E. true, at 150 fathoms.

The following particulars have been given by Mr. Smeaton. High water, at full and change, $V\frac{1}{4}h$. Rise of spring tides, 16 to 18 feet: neaps, 10 to 11. Tide up Channel, from west to east, from half-flood to half-ebb; and runs down the Channel, from east to west, from half-ebb to half-flood. As the turn of the tide is not at high or low water, but three hours after each, the tide is here said to run tide and half-tide.

2. ST. NICHOLAS' or DRAKE'S ISLAND.—Mr. Bayly, from his observations made in the observatory of Drake's Island, in 1772, concluded its latitude to be $50^{\circ} 21' 28''$; and the longitude, by means of the occultation of a star by the moon, compared with correspondent observations made at Greenwich, as $4^{\circ} 13' 30''$. See "*Observations made during the second and third voyages of Captain Cook*," by order of the Admiralty.

On *Plymouth breakwater* is a stone, about one-third of the length from the East end, marked $\frac{230}{T}$. Lieut. Stokes, of H.M.S. *Beagle*, has given its longitude from Greenwich, in time 16 m. 33.4 s. equal to $4^{\circ} 8' 21''$ W. Here ships of war, by Admiralty order, rate their chronometers before proceeding to sea.

Captain Fitzroy has remarked that the longitude of this station, by the Ordnance survey, would be $4^{\circ} 7' 41''.7$; but, by applying a portion of the error detected by Dr. Tiarks, in his chronometric observations between Greenwich and Falmouth, viz. $4s.09$, or $1' 11''.3$, the corrected longitude of the station will be $4^{\circ} 8' 43''$. "Our chronometers made it $0' 40''.2$ to the eastward of the corrected longitude, and $0' 19''.6$ to the westward of the original determination by the Ordnance Survey."—*Capt. Fitzroy's Appendix*, p. 320.

3. LIZARD POINT.—Dr. James Bradley, Astronomer Royal, from the mean between the results of several observations on the satellites of Jupiter, the passage of Venus over the sun in June, 1769, and an eclipse of the sun on the 4th of June, in the same year, deduced the latitude of the Lizard Point as $49^{\circ} 57' 30''$, and its longitude $5^{\circ} 13' 0''$.

4. **ST. PAUL'S STEEPLE** is given in the requisite Tables from the Ordnance Survey, as in $50^{\circ} 1' 24''$ N. and $5^{\circ} 21' 42''$ W., instead of the position since given, as in the present Table. The position will, also, be found corrected in the tabular statement of determined positions attached to the particular plans, in the collection of Harbours of the English Channel, &c. lately published by Mr. Laurie, and which exhibit other emendations. The collection of Harbour-charts here alluded to, with its companion, the General Chart of the Channel, indisputably constitute one of the finest, most accurate, and most useful, works of the kind that have ever appeared.

5. **ST. AGNES' LIGHTHOUSE, SCILLY.**—The observations made for determining the situation of St. Agnes' Lighthouse, at the commencement of the third voyage of Captain Cook, prove to be incorrect. It appeared, from these observations, to be in latitude $49^{\circ} 55'$, longitude $6^{\circ} 45'$. This error, of more than 25 minutes of longitude, has been very injurious, inasmuch as many charts were subsequently regulated by the deduction. For, the Lizard Point having been previously determined by Dr. Bradley, these islands were, in consequence, placed much too far from the Land's End. The fluctuation has, however, been completely set at rest by the Trigonometric Survey and the observations of the late Captain HUDDART. This gentleman, many years ago, visited the Scilly Islands, having with him a watch made by *Arnold*, and obtained his time at that spot where the body of Sir Cloudesley Shovel is said to have been thrown ashore, by means of equal altitudes of the sun's limb: he then found, comparing his time with that shown by the watch, that 0 h. 25 m. 18 s. was the difference in time between the meridian of Greenwich and this spot in St. Mary's. Now, St. Agnes' Lighthouse is about 2 minutes of a degree West of the place to which Captain Huddart alludes; therefore, $25' 18'' + 8'' = 25' 26''$ is the longitude of St. Agnes by these means; which differs only $4\frac{1}{2}$ seconds in time, or little more than one minute of longitude, from that found by the survey.—*Trig. Surv.* Vol. II. p. 135.

6. **SMALLS, GRASSHOLM, MILFORD HAVEN, &c.**—In the third volume of the Account of the Trigonometric Survey, the longitude of Grassholm is stated to be $5^{\circ} 47' 1''$, and that of the Smalls Lighthouse is printed $5^{\circ} 58' 34''$; but they are stated as in the Table, from a re-computation, obligingly communicated by Mr. J. Outhett. In the same volume, Milford Steeple is given as in $5^{\circ} 20' 13''$ instead of $5^{\circ} 0' 39''$ W.; and that of Hubberstone, as in $5^{\circ} 21' 47''$, instead of $5^{\circ} 2' 7''$ W. The station of CEFN BRYN is likewise given as in $4^{\circ} 56' 19''$ instead of $4^{\circ} 7' 25''$; the difference between it and Moel Rhyddlad having been added, instead of subtracted.

Pembrea Steeple is also given, in the same way, as in $4^{\circ} 48' 16''$, instead of $4^{\circ} 15' 28''$ W.—See *Trig. Surv.* Vol. III. p. 380.

7. **HOLYHEAD.**—Mr. George Thomas, on his survey of Holyhead Bay, in 1816, made the signal tower on the mountain in latitude $53^{\circ} 19' 6''$ and longitude $4^{\circ} 39' 39\frac{1}{2}''$.

8. **LIVERPOOL.**—Captain Denham, on his late survey of the Port of Liverpool, gives St. Paul's church in latitude $53^{\circ} 24' 39''$, and longitude $2^{\circ} 59' 30''$, or only 35 seconds more than the Ordnance survey.

VARIATIONS OF THE COMPASS.—The variation of the compass, at London, according to the observations made in 1824, was $24^{\circ} 9\frac{1}{2}'$ W. In the Thames' Mouth it has been, for some years past, about $24\frac{1}{2}$ degrees: in the Downs it is rather less: when Mr. Spence made his Survey, 1795, it was only $22^{\circ} 50'$; but it increases to the westward. At Dover, in 1833, it was 24° . At Spithead, in 1813, it was nearly or rather less than 25° . At Portsmouth Observatory it was given, in the same year, as $24^{\circ} 15'$. At Devonport, 25° W. 1831. At the Scilly Islands, in 1814, it was ascertained by Mr. Bain, and found to be nearly $27\frac{1}{2}^{\circ}$ W. This gentleman says, "In September, 1814, I determined the exact quantity of the variation at the Scilly Islands. The Sybille having continued two days at St. Mary's, during that interval I went with an azimuth compass, artificial horizon, and sextant, to St. Agnes' Lighthouse, and there took *twelve* observations, the mean result of which gave $27^{\circ} 16'$ West variation. In the evening I went, with the same instruments, to St. Mary's Castle, and there ascertained the variation, by an excellent amplitude, to be $27^{\circ} 31'$ W. The mean is $27^{\circ} 23' 30''$ W." See, further, the New Chart of the English Channel, &c. The present variation (1834) is very nearly the same. At Lundy Island the variation was 26° W. in 1832; in Milford Haven 27° in 1830; and in Liverpool Bay 27° W. in 1833.

At London, in 1834, it appeared to be under 24° W.

OF LIGHTHOUSES IN GENERAL.

We have lately given under the title of *PHARONOLOGY, in the Directories for the English Channel, Bay of Biscay, North America, &c.*, particular description of all the Light-towers and smaller Lights on the different coasts; but, as we cannot expect these books to be in every hand, and as some extraordinary mistakes have been made, even recently, which have produced the loss of valuable ships, we shall now subjoin to the different sections a summary of the whole, sufficient to prevent such mistakes in future, if attended to: and, as the distinctions of the various lights are not generally known, we make no apology for prefixing to the detail some observations on this subject which we have extracted from an instructive paper, given in the "*United Service Journal*," 1st of April, 1834.

"There are, at present, two principal modes of lighting; the French, the chief characteristic of which is the *lens*; and the English, which is fitted with *parabolic reflectors*, hereafter described.

"The French lens, proposed by Mess. Arago and A. Fresnel, in 1818, is one of the many great improvements which have been introduced by the '*Commission des Phares*,' according to the suggestions of the late *Admiral Rossel*, the hydrographer of the Navy. In this method the lantern is constructed with eight sides, which form an octagonal prism around the lamp. The centre of each side is occupied by a plano-convex lens, something similar to a burning-glass, having a diameter of about fifteen inches. From there being a limit to the size of the material, this, of itself, is not sufficient to cover the entire side. To remedy this defect, it is surrounded by a series of glass rings, whose external surface is so formed as to have precisely the same optical effect as the great central lens. A transverse section of one of these zones, or rings, presents the form of a wedge, one side of which is slightly curved. In the suggestion of this mean of extending the central lens, we are indebted to our countryman, Dr. Brewster, who, in 1811, in the '*Edinburgh Encyclopædia*,' proved that a lens might be formed of separate pieces. The present ingenious application to the purpose of lighthouses we owe to the French.

"It must be obvious that, in this method, it is essential that the light should be in the centre of the lantern, and of the greatest possible brilliancy; and with this view a lamp has been constructed with three concentric wicks, the external one having a diameter of three inches and a half. The inventors of this powerful light were, at first, alarmed lest the extraordinary heat should carbonize the wick: but they devised a mean by which the supply of the oil was so much increased, that no bad effect resulted. M. Fresnel assures us, that he kept a fourfold socket-lamp lighted for fourteen hours without snuffing it; and that the rays thrown by a lens placed before it had, at the end of this time, only diminished one-sixth of their original intensity. The Cordouan lighthouse, at the mouth of the Gironde, as shown hereafter, is illuminated in this manner; and it is generally supposed to be the finest light in the world.

"The English method of lighting is by oil, with parabolic reflectors. This consists of a number of Argand lamps, seven-eighths of an inch in diameter, placed in the foci of reflectors, resembling in shape the smaller half of an egg-shell. Their number is regulated by the degree of brightness required. These reflectors are of copper, lined with highly-polished silver, and have a diameter, generally, of twenty-one inches at the mouth, with a depth of nine; a hole is perforated above the flame, for the escape of the smoke, and there is a smaller aperture below, in which the supporter of the socket is enclosed. The first parabolic reflectors were used at Liverpool and Newcastle-on-Tyne, and we owe the invention and application to Captain Hutchinson, a dockmaster at the former place, and author of '*Practical Seamanship*.' The lighthouses lately erected on Beachy Head, and on the Black or Perch Rock, at the mouth of the Mersey, are considered as two of the best specimens of this mean of illumination. They are revolving lights, and are provided with thirty of these lamps and reflectors, there being three faces, and ten on each face.

"Many experiments have been instituted on the respective merits of these two methods, and, on the whole, philosophers are inclined to give the preference to the more recent invention of the lens. The unalterableness of the glass, and the lasting nature of its polish, are great advantages; and, in point of economy, it is decidedly preferable, as the quantity of oil it expends is one-third less than is used to produce the same quantity of light by the other plan; and an immense deal of labour and chance of neglect is spared, as the glass requires little cleaning, and as there is only one lamp to attend to. But this method is not without disadvantages. The difficulty of repairing the lenses, and the trouble attending on replacing the wicks, is very great; and, as the light depends upon one lamp, should any accident occur, the results might prove fatal; besides, it has been remarked, and can be demonstrated, that what the French lens gains in concentration of light it loses in divergency; twelve degrees is the utmost to be obtained: whereas in the English method, fifteen is the average quantity; that is, the English light would be visible on fifteen degrees of the horizon, the French only on twelve.

"For

"For the purposes of distinction, there are three sorts of lights—the *revolving*, the *fixed*, and the *coloured*; and these again are varied by *doubling* them. The light of a revolving lighthouse, from its being concentrated, will be seen at a much greater distance than a fixed light, which has its lamps disposed round a circle. Allowing two lighthouses to have an equal number of lamps and reflectors, the advantage in favour of the revolving light would be in the proportion of nearly three to two; that in the revolving lighthouse would be seen thirty-three miles, while the other would not throw its rays above twenty-two. Some revolving lights have four fronts. The smallest, of this sort, on the coast of England, under the directions of the Trinity-House, has five lamps on a face, and three faces. Buchanness, in Scotland, from the quick revolution of its reflector-frame, has the appearance of a *flashing* light. Mr. Stevenson received a gold medal for this invention, from his Majesty the King of the Netherlands.

"Fixed lights are principally advantageous in situations where it is requisite that only small portions of the horizon should be illuminated.

"Red lights are obtained in the English method, by placing a red glass before the reflector, which is extremely detrimental to the light, as it has the effect of absorbing most of the valuable rays, viz. the green, blue, and yellow. Red lights are found to be nearly sixty-five per cent less bright than white ones; and it frequently happens, in a revolving lighthouse, where two faces are white, and one red, that the red light will not be seen, when the white ones are clearly distinguished; but these lights are found extremely useful for local purposes. In some cases a white fixed light is arranged so as to have one or more red reflectors, which colour only the rays of light that illuminate the vicinity of shoals or other dangers; so that the navigator, to be in safety, must keep in the white light. At Caldy, in Wales, a fixed light has been constructed on this principle, having two red reflectors, which indicate a danger in the approach."

On this subject the scientific reader is also referred to Dr. Herschel's Account of some very interesting experiments on the powers of coloured glasses to intercept different rays, &c. *Ph. Trans.*, 1800, page 225; and to a paper by Dr. Brewster, entitled *Observations on Vision through Coloured Glasses*, *Edinburgh Phil. Journal*, Vol. 6, page 102.

The mode of producing an intense light by the action of gases upon lime, proposed and effected by *Lieut. Drummond*, of the Royal Artillery, and that of illuminating lighthouses generally, by mean of *gas*, are explained and discussed in the paper from which the above extracts have been made; a paper which we recommend to the attention of all who feel an interest in this important subject.

Capt. Livingston has noticed that "Planets, when rising, have not unfrequently been mistaken for lighthouses. When a vessel is so distant from a lighthouse that the light appears only a little elevated above the horizon which intervenes, the reflection of the light from the water sometimes makes it appear as if there were two lights, one above the other, in the same lighthouse. This monition may be useful."

It is not requisite to remind the reader that flags or balls are generally hoisted in the day, for the same periods as tide-lights by night; all such particulars being given in the Books of Directions which have been mentioned.

PHARONOLGY OF THE ENGLISH AND WELSH COASTS.

PRINCIPAL LIGHTHOUSES.—*Lights not otherwise described are of the brilliant or natural colour.* (Bearings by compass.)

The word *Time* expresses the interval between each appearance in full lustre. *Range* means the extent to which a light may be seen in clear weather.

ORFORDNESS; two stone towers; lights fixed, at 83 and 55 feet; seen at seven leagues off. In a line N.E. by E. $\frac{1}{4}$ E. and S.W. by W. $\frac{1}{4}$ W.

North Foreland; white tower; light fixed, at 340 feet; seen between 6 and 7 leagues off.

South Foreland; two white towers; lights fixed, at 380 and 275 feet; seen at six leagues. In a line E. by S. and W. by N.

Dungeness, the point of; a red tower; light fixed, at 92 feet; seen at $5\frac{1}{2}$ leagues.

Beachy Head (Belletout Cliff); a white tower; light revolves, at 235 feet; full every two minutes; seen at seven leagues. (See Note, page 4.)

St. CATHARINE'S POINT. A lighthouse of the first order, with brilliant fixed light, to be established in the year 1840, and seen from a distance of 6 or 7 leagues, in all directions seaward; thus aiding, in a material degree, the navigation at the back of the island.

Needles' Point, a white tower, with a fixed light at the height of 699 feet; from the time of the completion of that on St. Catharine's Point, the light will appear of a red colour. Range of light, between four and five leagues.

Portland, Bill of; two stone towers; elevations, respectively, 198 and 131 feet. Both lights are

are now brilliant and fixed, and when in one bear N.N.W. $\frac{1}{4}$ W. Ranges of light six and four leagues. The lower light visible only between W.N.W. South about to E. by N.

START POINT; a light tower, 110 feet high, finished in 1836. The light, powerful and revolving, is 204 feet above the level of high water, and appears full once in a minute. In addition to this, a *fixed light* is exhibited in the same tower, in the direction of Berry Head.

Eddystone; a stone tower, described in the Directory for the English Channel, 100 feet in height; the lights are fixed, at 92 feet above low water, and seen at five leagues off.

Falmouth; on St. Anthony's Head, forming the eastern side of the entrance; a light tower completed in 1835. The light appears in a quick, but regular, succession of brilliant flashes, at 65 feet above high water, and is seen more than five leagues off.

LIZARD POINT; two white towers; lights fixed at 221 and 224 feet; in one bear W. $\frac{3}{4}$ N. Range of light 20 miles.

Longships or Land's End; a square stone tower on the summit of the rocks; light *fixed*, at 88 feet. Seen 14 miles off.

SCILLY ISLANDS. On the isle of *St. Agnes*, a stone tower, coloured white, with brilliant revolving lights, at 138 feet above high water, in full lustre once a minute. Seen between five and six leagues off.

LUNDY ISLAND: a light tower of the first order, with two distinct and brilliant lights; the upper intermitting, without any interval of total darkness, and presenting a bright flash every 25 seconds, all round the circle. The lower light is *fixed*, and seen only from N.N.W. to W.S.W. (*by compass*). Range of light more than eight leagues.

BRISTOL CHANNEL. *Flatholm*, in the *Bristol Channel*; white tower, red top; light fixed, at 156 feet; seen at 17 miles.

Naze or Nash Point; two stone towers; lights fixed, at 167 and 123 feet; seen at 17 miles; 1000 feet apart; in a line S. 58° E. and N. 58° W.

Caldy Island; South point; a gray stone tower, with red top; light fixed and partly red, at 210 feet; seen at 20 miles. Red between S.E. $\frac{1}{4}$ E. and S.W. by S.

St. Anne's Head, Milford Haven; two towers; lights fixed, at 192 and 159 feet; seen at 17 to 19 miles. In a line N. by W. $\frac{1}{2}$ W.

Smalls, off St. Bride's Point; (*private property*;) light fixed, at 70 feet; seen at five leagues.

The Bishops, off Ramsey Island: a lighthouse on the southern rock, completed in 1839; the light *revolves*, and appears full at short and regular intervals. Range four or five leagues.

BARDSEY ISLAND; a stone tower, formerly with a flashing but now a regular fixed light, elevated 141 feet, and visible in all directions seaward from E. $\frac{1}{4}$ S. to N.E. $\frac{1}{4}$ E. Range $5\frac{1}{2}$ leagues.

South Stack, near Holyhead; a round white tower; light revolving at 201 feet; time two minutes: lantern open from N.E. by E. $\frac{1}{2}$ E. to S.E. A red light occasionally at 25 feet, when fogs obscure the upper light.

Holyhead Harbour.—See Harbour Lights hereafter.

Skerries, near Anglesea; a white tower with *fixed* light, at 117 feet; seen to the distance of five leagues.

LYNAS or Elian Point, on Anglesea: a light tower which formerly exhibited a fixed light, at 128 feet above the level of the sea, and seen at more than six leagues off, between N.W. $\frac{1}{4}$ W. and S.E. $\frac{1}{4}$ E.; but this has been altered to a flashing or intermittent light, becoming instantaneously obscured every ten seconds, and so remaining for two seconds only. (Nov. 1839.)

Twyndu or Black Point, on the west side of the entrance of Beaumaris Bay; a tower with *fixed red* light, from the 28th of June, 1838, visible from N.W. $\frac{3}{4}$ W. seaward, to S.W. $\frac{1}{4}$ W. excepting that, by the intervention of Puffin Island the light will be eclipsed upon the bearings from it of E. by N. $\frac{1}{2}$ N. to E. $\frac{1}{2}$ S.

Beware of approaching this lighthouse within the distance of 50 yards, as a ledge of rocks extends under water from the base of the building.

Point of Air, on the western side of the mouth of the Dee. A round tower, striped red and white horizontally; with two lights, the upper brilliant and fixed at 49 feet above high water; seen at $3\frac{1}{2}$ leagues; the lower of a red colour at 12 feet, and for the Welsh Channel only.

Black Rock, on the western side of the entrance of the Mersey: a round tower, with revolving lights at 77 feet above half tide: two brilliant and one red, each at intervals of a minute. Range of light, five leagues. A bell is tolled when requisite.

Lights for the Dee and the Mersey, to Liverpool; enumerated as *Harbour-lights* in the statement subjoined.

South end of Walney Island; a stone tower; light revolving, at 70 feet; time, five minutes; range between four and five leagues.

St. Bees' Head; a white tower: light fixed, at 333 feet. Range nearly eight leagues.

ISLE OF MAN. On the *Calf of Man*, two stone towers of unequal height, 560 feet from each other; in a line N.E. $\frac{1}{2}$ E. and S.W. $\frac{1}{2}$ W. Lights revolving; time two minutes; elevated 305 and 396 feet. Range between six and seven leagues.

Douglas Head; a tower, with fixed light; seen at five leagues off. First lighted 21st December, 1832.

Point of Ayre; a stone tower; light revolving at 100 feet; time, two minutes; bright and red alternately. Ranges five and four leagues.

HARBOUR AND TIDE-LIGHTS.

THAMES AND ENGLISH CHANNEL.—*Margate*, a stone tower on the pier-head, 70 feet high, with red light at 85 feet above the level of high water, seen to the distance of three leagues: a lantern light on the jetty head. *Ramsgate*, tide of 10 feet, red: *Dover Harbour*, tide of 10 feet, two; both red: *Folkstone*, tide of 9 feet: *Rye*, tide of 9 feet, two: *Newhaven*, 1st of September to 1st of May, two: *Brighton* pier-head, a green light and a ball: *New Shoreham*, two, one of which only with tide of 11 feet, and a red signal by day.

South Sea Castle, a bright red light: *Calshot Castle*, light of two colours, brilliant and red: *Hurst Beach*, two, in a line N.E. by E. $\frac{1}{2}$ E.: *Torbay*, on Brixham pier-head, a red light, from September, 1839: *Dartmouth*, west side of the entrance, on St. Petrock's Castle; a fixed light of a deep red colour, visible between N.W. $\frac{1}{2}$ N. and N. by E. at 7 miles: brightest when bearing about N. by W. $\frac{1}{2}$ W.; but not lighted in June, July, and August. *Plymouth Harbour*, a fixed light: *Penzance* pier, with tide of 10 feet: *Bideford*, two, with tide of 10 feet, and a red ball near the low light in the day.

Light-vessels.—At the Nore, with one light; tail of the *Mouse*, one light: *Goodwin North Sand Head*, with three lights; *Gull Stream*, with two lights; *South Sand Head*, with one light; *Owers*, with one light; *Bembridge*, with two lights; *Plymouth Breakwater*, west end, with two lights.

BRISTOL AND ST. GEORGE'S CHANNELS.—*Burnham Harbour*, two lighthouses, in a line E.S.E.; the upper light, at 91 $\frac{1}{2}$ feet above the level of high water, intermits every 3 $\frac{1}{2}$ minutes for 30 seconds; the lower light, at 23 feet, is steady or fixed: a light-vessel, between the English and Welsh grounds, in 6 $\frac{3}{4}$ fathoms, with revolving light, at 10 $\frac{1}{2}$ miles westward of King Road: entrance of the *Uske* or *Newport River*, one light on the western side; *Mumbles Point*, one: *Swansea* pier-head, tide of 8 feet, a red light: *Burry Port*, east of Pembrey, with 10 feet of water, lights bright, blue, and red; the red eastward. Light on the *Bishops*, described with the superior lights above.

Aberaeron and *Aberystwith*, small tide-lights: *Holyhead Harbour*, tower on the pier-head, with two lights: the upper brilliant, and seen to three leagues; the lower bright red, 20 feet beneath the upper, and not visible until in a S.S.W. direction. Vessels should not haul in for the harbour until the red light comes in sight. *Amlwch*, two poor harbour lights.

LIVERPOOL BAY.—(*Air Point*; see principal lights above.) *Hoyle Lake lights*, near *Helbre Point*, on the *Cheshire* coast, two white towers, with fixed lights at 71 and 47 feet. In one bear S.W. $\frac{3}{4}$ S. Range of light two to three leagues. *Sea lights.*—*Leasowe*, or *Lizza*, and *Bidston*, leading to the *Horse Channel*; the first, a white tower, with fixed light at about 105 feet; range five leagues; the second, of a dark colour, with light at about 240 feet. *Black Rock*, see above.

Light-ship in the Bay, with three bright lights, seen at 8 or 9 miles off; by day a blue flag, with letters N.W. in white. Hull painted black, with broad white streak; a blue light once in two hours by night; a gong in thick weather.

Crosby Lighthouse, for the *Victoria Channel*, from Oct. 10, 1839; light of a red colour, at 96 feet above half tide. This lighthouse, with a beacon surmounted by a black ball, lead into the channel, which is also distinguished by a vessel with one mast, showing a bright light, red flag, and hull painted red.

Lytham Harbour, on the north side of the entrance, a tide-light; *Whitehaven*, harbour lights upon the outer and inner pier-heads; the outer revolving, making its circuit in two minutes: the inner is a tide-light, with 9 feet of water between the pier-heads; a flag, &c. *Harrington*, a lantern, denotes 3 feet of water; *Workington*, tide lights, two, with 8 feet of water; *Maryport*, a single light with 3 feet of water; *Salterness* or *Southerness*, at the mouth of the *Nith*, harbour light in a white tower, at 50 feet.

ISLE OF MAN.—*Port le Murray*, one harbour-light; *Castletown*, one, during the herring fishery; *Derby Haven*, the same; *Douglas*, on the pier-head; *Ramsey*, the same; *Peel Harbour*, the same.

REMARKS on the LIGHTHOUSE of LUNDY ISLAND.

The loss of the *Jeune Emma*, of Cherbourg, in 1828, by mistaking Lundy Island for that of Ushant, and that of the *Elizabeth*, in 1833, by mistaking the same light for that of Cape Clear, have induced us to insert the appearance of Lundy Island, as annexed, from a survey of this island by Captain Denham. The particulars of the *Jeune Emma* will be found in the Observations on Currents hereafter. The *Elizabeth*, a ship of 600 tons, belonged to Liverpool, was returning to that port from Calcutta, with a rich cargo, in December, 1833; but, as reported, mistaking the Lundy for the Cape Clear lights, she was wrecked in the night on the south tail of Bideford Bar. Happily the crew were saved.

Let it be recollected that the tower of Lundy exhibits two distinct lights; the upper revolving, without any interval of total darkness, all round the circle; the lower one faces the West, and exhibits a fixed and steady light over 90 degrees of the horizon only; or from N.N.W. to W.S.W. by compass. The land on which the lighthouse is erected is so high that the upper light is 542 feet above the mean level of the sea; the lower light, 470 feet. There are eight lights in the upper, and four in the lower, lantern: but it has been noticed that, at a certain distance from the island to the westward, the whole appears like one very strong revolving light. This should be generally known; and also, that, if there be any haze in the Channel, the lights are often invisible; for, from the great elevation of the lights, it happens, at times, in moderately clear weather, that the island may be seen when the lights are obscured in the atmosphere.

2. ISLANDS AND COASTS OF SCOTLAND.

	LATITN.	LONG. W.	AUTHORITIES.
	° ' "	° ' "	
EDINBURG; the Observa- tory .....[1.]..	55 57 23	3 10 45	The GRAND TRIGONOMETRIC or ORDNANCE SURVEY of Great Britain, under the direction of COLONEL COLBY, to 1835.
East Lomond	56 14 31	3 13 10	
Fifeness	56 17 0	2 34 40	
Bell Rock Lighthouse.....	56 26 3	2 23 6	
Dundee Law	56 28 41	2 58 26	
Button-ness; High light....	56 28 7	2 44 53	
Aberbrothick; the Abbey....	56 33 45	2 34 53	
Red Head	56 36 55	2 29 24	
MONTROSE; Round Tower..	56 42 5	2 26 6	
— Spire	56 42 31	2 27 51	
ABERDEEN; Marischal Col- lege	57 8 57	2 5 42	
Old Aberdeen; Northern blunt spire	57 10 11	2 6 3	
Belhelize or Orrock; dove-cote	57 15 52	2 3 57	
Buchan-ness Lighthouse....	57 29 15	1 47 0	
Peterhead; Old mill	57 30 43	1 47 31	
Rattery Head; Pile	57 36 52	1 50 39	
Fraserburg Lighthouse, on Kinnaird Head	57 41 51	2 0 6	The OBSERVATIONS of Mr. GEO. THOMAS, R.N., on his Survey of Shetland, &c., 1825 to 1833.
Troup Head; staff	57 41 38	2 17 38	
Macduff; Spire	57 40 5	2 30 0	
TARBETNESS; Lighthouse ..	57 50 56	3 48 25	
Duncansby Head; Station..	58 40 22	3 1 7	
ORKNEY.—Pentland Sker- ries; Lights.....	58 41 10	2 55 2	
Stromness; Church	58 57 49	3 23 41	
Start Point of Sanda; Light- house	59 16 30	2 30 0	
Fair Island; summit	59 32 54	1 37 50	
Foul Island (summit 1369 ft.)	60 8 28	2 5 40	
SHETLAND.—Sumbro Head Lighthouse [2.]	59 51 20	1 16 27	

ISLANDS AND COASTS OF SCOTLAND CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
Brassa Island; summit (742 feet)	60	7	51	1	5	49	The OBSERVATIONS of Mr. GEO. THOMAS, R.N., on his Survey of Shetland, &c., 1825 to 1833.
LERWICK; the fort flagst.	60	9	22	1	8	41	
Gardie House on Bressa[3]	60	9	24	1	7	40	
Whalsey Island; summit.	60	20	1	1	0	22	
Brury Isle, Out Skerries..	60	25	41	0	45	2	
Yell Isle; Reafrith Kirk..	60	35	55	1	3	46	
Strandburg Ness, Fetlar ..	60	33	51	0	53	36	
Fetlar Isle; summit (521ft.)	60	37	12	0	51	56	
Haaf Gruna; summit....	60	39	44	0	50	24	
Balta Island; summit....	60	45	3	0	47	17	
Lambaness, on Unst	60	49	0	0	45	40	Mr. Thomas's Survey of the Shetland Islands.
Burraford Holms.....	60	51	0	0	53	30	
Ramna Stacks.....	60	39	36	1	18	40	
Ve Skerries, off St. Magnus Bay	60	22	30	1	49	10	
Fugloe Skerry, near Papa	60	20	15	1	45	0	
Scalloway Castle	60	8	31	1	16	25	
WESTERN COASTS of SCOT- LAND.							
Cape Rath; Lighthouse....	58	36	35	4	58	20	Captain Huddart's Survey of the Western Islands, &c., with a trifling correction.
Loch Laxford; Entrance ..	58	24	0	5	4	20	
Stornoway in Lewis	58	12	20	6	20	0	
Ullapool in Ross ....[4]..	57	53	30	5	3	30	
Glash or Scalpa; Lighthouse	57	50	20	6	37	30	
Loch Nawaddy; Entrance..	57	34	20	7	5	0	
Barra Head Lighthouse	56	47	20	7	35	0	
Tobermorey, in Mull	56	38	0	6	2	20	
Mull of Cantire; Lighthouse	55	20	0	5	43	30	
Campbell-Town	55	25	0	5	36	30	
St. Kilda .....[5]..	57	49	30	8	32	30	Mr. Lamont and Capt. Huddart.

NOTES.

1. EDINBURG.—For the positions of places in the east of Scotland, southward of Edinburgh, the reader is referred to our 'Sailing Directory for the North Sea,' 6th Edition, 1838. Of the Astronomic Observatory at Edinburgh, the longitude appears to have been finally settled, in 1839, by Professor Henderson, who gives it as 12 m. 43 s. or 3° 10' 45", in lieu of the previous statement, 3° 10' 54".

2. SHETLAND.—We have given the several points of Shetland, in the Table, on the authority of Mr. Thomas, one of the most accurate and experienced surveyors of the British navy. There have been singular variations on these points, and the names of Kerguelen, Lovénor, Donelly, and Brodie, have successively been mentioned, in connection with the longitude of Lambaness, which has been reported from 0° 15' to 0° 59'; now happily settled as 0° 45' 40" W.

3. LERWICK, &c.—Captain *John Ross*, in the narrative of his voyage, 1818, gave the longitude of *Gardie House*, on *Bressa*, from the mean of his chronometers, as 1° 15' 52", which caused a removal of all the islands in the charts to a situation too far to the west; but the error can now be corrected; as *Gardie House* is in 1° 7' 40" only, and *Lerwick* in 1° 8' 41"; not, as formerly given, in 1° 18' 0" W.

4. WEST OF SCOTLAND.—For the western coasts and Islands of Scotland, we have made use

use of the survey by Captain Huddart, a chart exhibiting the data on which it has been composed. This survey was carried on, as stated by the author, "from observations made at Campbell-town, Tobermorey, Cana, Ullapool, Laxford, Stornoway, Glash, Namaddy, and Barra, to determine the latitude and longitude by astronomical instruments and chronometers; from which a series of triangles, determined from the true meridian, was carried on, to find the situation of the intermediate places and remarkable objects, as data for laying down the soundings," &c., and in the comparison had not to correct any of the above-mentioned places more than about half a statute mile.

5. ST. KILDA.—In July, 1806, Mr. Lamont, jun. surveyed the islands of St. Kilda, Borea, &c. His results agree very well with Captain Huddart's. A general southerly current prevailed during the whole 20 or 21 days he remained on and about the islands; and is known to prevail during summer. St. Kilda is said to be visible from the hills of Skye, in very clear weather.

A Description of *St. Kilda, the Flannan Isles, Barra, Rona, &c.*, is given in our 'Memoir and Directions for the Northern Ocean,' pages 12 to 16.

VARIATIONS OF THE COMPASS.—In the Frith of Forth the variation was $28^{\circ} 15' W.$ in 1815: at Fetlar, Shetland, Mr. Thomas found it to be $28^{\circ} 16' W.$ in 1827: at Balta, $28^{\circ} 26'$. In 1833, on the west of the islands, $28^{\circ} 30'$; on the east, in lat. $60^{\circ} 15'$, $27^{\circ} 40'$: at the Pentland Skerries, $29^{\circ} 19'$, in 1830: near Cape Rath, in 1819, it was $30^{\circ} W.$: at St. Kilda, in July, 1806, Mr. Lamont, jun. found it to be $31\frac{1}{2}^{\circ} W.$ Near the high rock, named *Rokol*, in latitude $57^{\circ} 39'$, longitude $13^{\circ} 31'$, it was about 33° in 1810.

PHARONOLOGY OF THE COASTS OF SCOTLAND.

PRINCIPAL LIGHTHOUSES.—*Lights not otherwise described are of the brilliant or natural colour.* (Bearings by compass.)

THE EASTERN COAST.

ISLE OF MAY; a stone tower on the summit of the isle, with fixed light at 240 feet above high water. Range of light, seven leagues. (*See Directory for the North Sea, p. 102.*)

BELL ROCK; a stone tower, with revolving light, appearing alternately red and brilliant, at the height of 90 feet. Ranges of light, five and four leagues. A bell, &c., in thick weather.

Girdleness, near Aberdeen; a tower with two fixed lights, at 185 and 115 feet above the mean level of the sea. Ranges of light, four and five leagues.

Buchanness; a stone tower, with a light *flashing once in every five seconds*, and visible 16 miles off.

Kinnaird's Head, near Fraserburg; a stone tower with fixed light at 120 feet above high water; Range of light, five leagues.

Tarbetness, near Moray Frith, a tower with *intermittent* light at 175 feet above the sea, visible to six leagues. The light appears suddenly like a bright star for $2\frac{1}{2}$ minutes, and is then eclipsed for half a minute, and thus alternately.

Pentland Skerries; two stone towers; light fixed, respectively, at 100 and 80 feet; seen at four and five leagues off. In a line N.N.E. and S.S.W.

Dunnet Head, the northern extremity of the main land of Scotland; a stone tower, with fixed light, at 346 feet above the mean level of the sea; Range of light, seven leagues.

ORKNEY. Start Point of Sanda; a stone tower, with revolving light, refulgent once in a minute, at 100 feet above high water, visible at five leagues.

SHEETLAND. On *Sumbro Head*, the S.E. point of the main land of Shetland; a stone tower, with fixed light at 300 feet above high water. May be seen more than seven leagues off, but is frequently obscured in cloudy weather.

THE WESTERN COASTS.

CAPE RATH or Wrath; a white tower; light revolving, at 400 feet; time, two minutes; red and bright alternately; seen at eight leagues.

Glash or Scalpa, near Lewis; a stone tower; light fixed at 130 feet; seen at five leagues off.

Barra Head, Isle of Bernera, latitude $56^{\circ} 47'$; a stone tower; light intermittent at 630 feet; eclipsed in every three minutes, for half a minute; seen at 30 miles. Open from N. by E. to E.N.E.

Oversa, or S.W. point of Ila; a stone tower; flashing light every twelve seconds, but without any interval of total darkness: elevated 150 feet above the sea: range of light, six leagues.

Mull of Kintyre or Cantire; a stone tower, light fixed, at 297 feet; seen at 22 miles off.

Pladda Isle, near Arran; two stone towers; lights fixed at 130 and 77 feet; seen at four and five leagues off. In a line bear North.

Corsewall Point, at the entrance of *Loch Ryan*; light revolving, at 112 feet; time, each two minutes; bright and red alternately; Range, five and six leagues.

Mull of Galloway; a stone tower; light intermittent, at 325 feet: eclipsed in every three minutes for half a minute; when not obscured by clouds, seen at seven leagues off.

HARBOUR AND TIDE-LIGHTS.

For the Harbour and Tide-Lights in the Frith of Forth and other Friths of the Eastern coast, the reader is referred to our 'Sailing Directory for the North Sea.' On the Atlantic or Western coast they stand as follow: taking them in order from south to north.

Port Patrick, light on the pier-head, 1st of Sept. to 1st of May; *Ayr Harbour*, two on one building, (one red,) and a tide-light for 8 feet; *Troon Harbour*, a gas-light, eclipsed once a minute; *Ardrossan*, a small harbour-light; *Cumbræ* or *Cumray*, at the mouth of the Clyde, fixed light, seen at three or four leagues off. *Toward Point*, on the western side of the Clyde, revolving, time, one minute; *Clough*, on the eastern side of the Clyde, a fixed light; *Greenock*, harbour-light on the custom-house pier; *Port Glasgow*, a bright light on the pier, and a red one on the west kay of the harbour.

Campbell town, in Kintyre or Cantire, one harbour-light. Near the S.W. point of *Lismore Island*, opposite to the eastern entrance of the Sound of Mull, a fixed light, on an islet called *Mousedale* or *Lady's Isle*. The last is elevated 103 feet above the level of the sea, and may be seen at four leagues off.

COAST OF NORWAY.

It has not been made generally known that there is now a tower on *Gunnarshoug*, the lower *Land of Lister*, in latitude $58^{\circ} 5' 30''$, longitude $6^{\circ} 35' 30''$ E., with an intermittent light at 125 feet above the sea, displaying a bright flash every minute, which continues for 12 seconds. The light does not appear totally eclipsed within the distance of eight miles, and is seen from all points seaward between S.W. $\frac{1}{2}$ W. and N.N.W.

On *Waruës*, forming the south side of the entrance to *Lister Fiord*, at $4\frac{1}{2}$ miles N.E. $\frac{3}{4}$ E. from *Gunnarshoug*, is a fixed harbour-light, seen generally to the distance of six miles from all points between west, by the south, to east and N.E. by E. When bearing E.N.E. $\frac{1}{4}$ E., its strongest light may be seen at the distance of $3\frac{1}{2}$ to 4 leagues.—(See the Chart of the South Coast of Norway, from the Danish Surveys, published by Mr. Laurie.)

3. COASTS OF IRELAND, &c.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
THE NORTHERN COAST.							
Tory Island; Lighthouse [1.]	55	16	27	8	15	19	The SURVEYS of Captain Wm. MUDGE, R.N., F.R.A.S., made in co-operation with the Grand Trigonometric Survey of Ireland; 1828-1830.
Fannet Point; Lighthouse ..	55	16	34	7	38	6	
Innistrahul; Lighthouse	55	25	54	7	13	51	
Innishoen Head; Lighthouse	55	14	20	6	56	0	
Magilligan Tower, L. Foyle.	55	11	32	6	57	58	
Port Rush	55	12	30	6	40	15	
Bengore Head .....[2.]..	55	15	0	6	29	35	
Rachlin Isle; Church	55	17	35	6	12	2	
———— N.E. point	55	18	0	6	10	40	
Race of Skerinoe, 15 fms. ..	55	19	20	6	7	15	
Knocklaid Mountain (1690 ft.)	55	9	42	6	15	13	* * * THESE SURVEYS, put forth without the slightest tincture of ostentation, are of the most valuable description. The statement from them, hereto annexed, enables a commander from BELFAST, or any other given port, to commence his Journal with confidence, being assured that his first point of departure may be relied on, as <i>positively correct</i> .
Fair Head	55	13	30	6	9	30	
THE EASTERN COAST.							
Tor Point.....	55	11	50	6	4	10	
Garron Point	55	3	0	5	58	30	
The Maidens; Eastern Light	54	55	30	5	44	10	
Hunter Rock (9 feet)	54	52	45	5	45	30	
Black Head	54	46	0	5	42	0	
Carrickfergus	54	42	35	5	49	15	

COASTS OF IRELAND, &c. CONTINUED.

	LATIT. N.	LONG. W.	AUTHORITIES.	
BELFAST; Mouth of the Lagan	54 36 0	5 56 0	The Surveys of Captain Wm. MUDGE, R.N., F.R.A.S., made in co-operation with the Grand Trigonometric Survey of Ireland; 1828-1830.	
— Divis Mount (1800 ft.)	54 36 39	6 1 17		
Bangor Castle	54 39 20	5 40 40		
Copeland Lighthouse	54 41 43	5 31 34		
Donaghadee; Pier Head ..	54 38 38	5 32 25		
Ballyhalbert; Fort	54 29 30	5 28 10		
South Rock Lighthouse	54 23 55	5 25 18		
St. John's Point	54 13 20	5 40 0		
Slieve Donard (2797 feet) ..	54 10 48	5 55 26		
Carlingford Lighthouse	54 1 11	6 4 55		
— Hill (1580 feet)	54 2 39	6 13 9		
Clogher Head	53 47 40	6 14 0		
Drogheda; centre	53 42 50	6 22 0		
Balbriggan Light.....	53 36 46	6 10 53		
St. Patrick's Island	53 34 45	6 5 20		
Lambay Island; summit ..	53 29 20	6 2 0		
Nose of Howth	53 22 50	6 3 50		
Howth Hill; peak, 565 feet	53 22 23	6 4 20		
Poolbeg Lighthouse	53 20 30	6 9 16		
DUBLIN; Nelson's Pillar[3.]	53 21 0	6 16 45		
Kingstown; Lighthouse....	53 18 5	6 9 0		
Tuskar Lighthouse	52 12 15	6 7 0		
			Inferred by Chart from Kingstown.	
THE SOUTHERN COAST.				
Great Saltee Isle	52 5 45	6 37 29	The ADMIRALTY SURVEYORS, under the direction of Captain MARTIN WHITE, R.N., in and subsequent to 1819.	
Coningmore Rock	52 4 4	6 37 49		
Hook Lighthouse, near Waterford	52 6 34	6 58 21		
Helwick Head	52 3 0	7 26 12		
Cruach Hill, Dungarvan; the S.W. end	52 7 30	7 37 0		
The Mount Knockmell down.	52 13 33	8 0 32		
Roche Point; Lighthouse ..	51 48 19	8 14 35		
Robert Tower	51 44 45	8 18 30		
Daunt Rock	51 43 58	8 17 15		
Kinsale; southern light	51 36 18	8 33 17		
Fylnesshawk Tower	51 32 53	9 5 22		
Stags of Castlehaven	51 27 15	9 13 46		
CAPE CLEAR; Lighthouse [4.]	51 24 56	9 29 8		
Scull Harbour; S.W. point ..	51 29 23	9 34 5		
Fastnet Rock	51 22 15	9 36 18		
Coney Island	51 28 56	9 35 35		
Crookhaven; Coghlan's Tower	51 27 3	9 43 27		
Brow Signal Tower.....	51 26 9	9 46 25		
Mizen Peak	51 26 41	9 49 8		
Mount Gabriel; North pap..	51 32 30	9 33 6		
Sheep Head	51 31 18	9 51 40		
Roanharic R. in Bantry Bay	51 39 3	9 45 19		
Hungry Hill; pyramid (2240 ft.)	51 39 40	9 48 6		
Dunbui House, Bear Haven	51 37 4	9 54 6		
THE WESTERN COAST.				
Dursey Island; Tower	51 35 18	10 14 1		
Bull Rock	51 34 51	10 19 55		

COASTS OF IRELAND, &c. CONTINUED.

	LATIT. N.	LONG. W.	AUTHORITIES.
Skelligs; Western rock	51° 46' 10"	10° 34' 10"	The ADMIRALTY SURVEYORS, under the direction of Captain MARTIN WHITE, R.N., in and subsequent to 1819.
Valentia Isle; Fort Cromwell	51° 55' 1"	10° 19' 5"	
Doulus Head .....[5]..	51° 56' 6"	10° 19' 12"	
Dunmore Head, Dingle Bay	52° 6' 39"	10° 30' 50"	
Foze Rock	52° 1' 15"	10° 41' 50"	
Inishtuiskan Island	52° 8' 0"	10° 35' 30"	Various Surveys of the West- ern Coast.
Beal Point	52° 34' 50"	9° 37' 48"	
Scattery Island	52° 36' 1"	9° 31' 7"	
Loop Head; Lighthouse ...	52° 33' 51"	9° 52' 29"	
Slyne Head; Lighthouse ...	53° 24' 0"	10° 9' 0"	
Clare Island; Lighthouse ...	53° 49' 30"	9° 56' 0"	The Grand Trigonometric Sur- vey above mentioned.
Achil Head	53° 58' 20"	10° 12' 0"	
Eagle Island; Lighthouse ..	54° 16' 40"	10° 3' 0"	
Telling or Teelin Head	54° 40' 30"	8° 47' 30"	
Ballyshannon Church	54° 30' 11"	8° 11' 47"	
SlieveLeague(summit 1979 ft.)	54° 39' 5"	8° 42' 38"	
Bloody Farland (summit 1060 feet)	55° 8' 14"	8° 15' 41"	
Muckish Hill: eastern part (2202 feet)	55° 6' 21"	7° 59' 49"	

NOTES.

1. TORY ISLAND.—We formerly gave the west end of Tory Island, from Captain Huddart, in $55^{\circ} 17' 40''$, and $8^{\circ} 16'$. Hence a difference, in latitude, of 73 seconds, and in longitude of 41 seconds only.

2. BENGORE HEAD and BALLYCASTLE.—In Dr. Beaufort's Memoir, Bengore Head is given as in $55^{\circ} 15'$, and Ballycastle as in $55^{\circ} 12'$, from the observations of the Rev. W. Hamilton. Captain Livingston, from particular observations made by him, on passing, says, that Fair Head does not lie more to the northward than $55^{\circ} 14'$. All this is now verified by Captain Mudge's Survey.

The Book of Directions, published by Mr. Laurie, to accompany the CHART of ST. GEORGE'S CHANNEL, with all the COASTS of IRELAND, contains a particular description of Bengore Head, and of that stupendous curiosity, the GIANT'S CAUSEY, forming the western side of it. The mariner should know that these huge columns of basalt abound in ferruginous matter, which, on a near approach, derange the compass in all directions. FAIR HEAD, to the eastward, is similarly constructed; and among the innumerable basaltic columns at this celebrated promontory, is a quadrangular prism, 33 feet by 36, on the respective sides, and upwards of 200 feet in height. This column is supposed to be of the largest dimensions of any single shaft in the world. The depth of water near the cape is such, that vessels of considerable burthen can ride within a cable's length of it.

3. DUBLIN.—The astronomic observatory, three miles to the N.W. of Dublin, stands in latitude $53^{\circ} 23' 13''$, and longitude $6^{\circ} 20' 30''$, as shown in the 'Nautical Almanac,' 1838-1840.

4. CAPE CLEAR.—The position of Cape Clear appears, at length, to be satisfactorily ascertained. We had occasion to show, in our former editions, the uncertainty, with regard both to the latitude and longitude, of this important point; and it may still be proper to notice that the latitudes formerly given, by different observers, varied from $51^{\circ} 19'$ (that of Mackenzie and the requisite tables) to $51^{\circ} 28'$. The longitudes, in like manner, varied from $9^{\circ} 23'$ to $9^{\circ} 40'$. Admiral Knight, in 1800, when captain of the Montague, gave the latitude as $51^{\circ} 25'$, and the longitude as $9^{\circ} 30'$: this, it will be seen, varies only one minute, and that in longitude, from the result of the late observations; an instance of accuracy very honorable to its author. The lighthouse near this cape is noticed hereafter.

5. DURSEY ISLAND, &c.—It has been fully ascertained that the S.W. coasts of Ireland have been laid down in the surveys of Mackenzie, &c. too far to the south. By a paper, printed for the Hydrographic Office at the Admiralty, in 1801, entitled “Remarks on the S.W. and N.W. Coasts of Ireland, by Lieut. T. G. Shortland, of H.M.S. *Melpomene*,” it appeared that, on making Dursey Island, off Bantry Bay, this gentleman observed with one of Ramsden’s best sextants, and found the latitude of the S.W. end of it $51^{\circ} 37' N.$; and, being off there for three successive days, still found it the same; every quadrant in the ship, at the time, agreeing within a mile or two of his observation.

Sailing still on, past the Skelligs and Blasquet, next day, he observed off the mouth of the Shannon, when Loop Head appeared to be in $52^{\circ} 37'$, Kerry Head $52^{\circ} 30'$, and Brandon Head $52^{\circ} 22'$. Captain Shortland remarks, that he was off there five days, and had excellent observations; and it was inferred that the part of the coasts of Ireland, between Dursey Island and Urris Head, had been laid down about 10 minutes to the southward of the truth; an error to which was ascribed the loss of the *York*, Indiaman, in Tralee Bay, on the 29th of October, 1758.

But it since appears, from the observations of Captain White, that those above described give the latitudes rather *too far to the north*; Capt. W. placing Loop Head in 3 minutes less, and Dursey Island in 2 minutes less, than Capt. Shortland.

VARIATIONS OF THE COMPASS.—In Dublin Bay, the late Admiral Bligh found the variation to be $26^{\circ} 48'$ in December, 1800. Captain Mudge, in 1830, gave it as $26^{\circ} 30'$. On the South of Ireland, near Cork, it was found, at the same period, to exceed $27\frac{1}{2}$ degrees: and, on the North of Ireland, about 29 degrees. In 1830, off the N.W. coast, it was found in lat. $55^{\circ} 25'$, longitude $10^{\circ} 0'$, to be $30\frac{1}{2}^{\circ} W.$ In lat. $55^{\circ} 17'$, long. $11^{\circ} 0'$, to be $31\frac{1}{4}^{\circ} W.$; and, in $54^{\circ} 50' N.$, long. $10^{\circ} 30'$, it was $30\frac{3}{4}^{\circ} W.$

PHARONOLOGY OF IRELAND.

PRINCIPAL LIGHTHOUSES.—*Lights not otherwise described are of the brilliant or natural colour.* (Bearings by compass.)

NORTH and EAST COASTS.—*Tory Island*; a stone tower, with fixed light at 122 feet; Range of light, more than five leagues. First lighted 1st August, 1832.

Ennistrahl; a white tower; light revolving, at 167 feet; time two minutes. Range of light, six leagues.

Maiden Rocks, near Lough Larn; two white towers, in a line N.W. $\frac{3}{4}$ W. Lights fixed at 94 and 84 feet, and seen at 14 and 10 miles off.

Copeland, on Cross Isle; a white tower, with fixed light, at 131 feet; seen at five leagues off.

South or Kilwarlin Rock; a white tower; light revolving, at 52 feet; time, one minute and a half. Range of light, four leagues.

Howth Bailey, near Dublin; a white tower, light fixed, at 114 feet; and seen at 17 miles off.

Wicklow Head; two white towers; lights fixed, at 250 and 121 feet; seen at 21 and 16 miles off. In a line bear N.W. by W. $\frac{3}{4}$ W.

Tuskar, off Carnsore Point; a white tower, with revolving light at 105 feet; two sides bright, one red; time of each, two minutes. Ranges of light, five and four leagues.

SOUTH COAST.—*Hook Tower*, near Waterford; white; fixed light at 139 feet; seen at 17 miles off.

Roches Point, near Cork Harbour; a white tower with fixed light, red to seaward, at 92 feet. Seen at 14 miles off.

Old Head of Kinsale; a white tower, with fixed light, at 294 feet: range more than seven leagues.

Cape Clear Island; a white tower, on the S.E. side, with revolving light, at 455 feet: time, every two minutes. Range of light, more than eight leagues.

WESTERN COAST.—*Skelligs*; two white towers, 650 feet apart; fixed lights at 372 and 173 feet; seen respectively at eight and six leagues. In a line N. by E. and S. by W.

Loop Head, by the Shannon; a white tower with fixed light at 269 feet; seen at seven leagues off.

Killaney or South Arran, off Galway Bay; a white tower, with revolving light, at 498 feet; time, three minutes. Seen at nine leagues off.

Slyne Head, the islet so called; two white towers, 415 feet apart, in a line N. by E. and S. by W. The northern one has a revolving light, at 112 feet, with one red and two brilliant faces; each face appears once in two minutes: the southern is a fixed light at 104 feet, and shows seaward from S.E. $\frac{3}{4}$ E. to E. by N. Ranges of light, 14 and 16 miles.

Clare Island, off Newport Bay; a white tower on the N.E. point, with fixed light at 487 feet, seen at nine leagues off.

Eagle Island, near Urris Head; two towers, with fixed lights at 220 feet above high water, in a line bearing E. by N. and W. by S. Range of light, seven leagues.

Tory Island; see above.

HARBOUR AND TIDE-LIGHTS.—IRELAND.

FANNET POINT, on the left side of Lough Swilly, a white tower, with fixed light at 90 feet, red to seaward, bright to the Lough, seen at 14 miles off: *Innishowen*, on the west side of the entrance to Lough Foyle; two white towers, 460 feet apart, at three-quarters of a mile southward of Innishowen Head, with fixed lights at 73 feet, in a line bearing west, and thence open to the bearing of S.W. $\frac{1}{2}$ S. Range of light, four leagues.

Lough Larne, east side of the entrance, a round tower, with fixed light at 47 feet, showing, from the northward or seaward, from south to east. *Donaghadee*; a round tower on the pier-head, with fixed light at 63 feet: seaward, between N. by E. $\frac{1}{2}$ E. and S. $\frac{1}{2}$ E., the light appears red; but is bright toward the harbour and entrance of Belfast Lough: the range, $3\frac{1}{2}$ leagues. *Ardglass Pier*, on the larboard side, tower with red light, carried away by the sea 27th November, 1838, but another to be erected. *St. John's Point*, near the same, a lighthouse proposed, but not completed in 1839.

CARLINGFORD LOUGH, on Hawlbowl Rock, a white tower with two fixed lights, the lower from half-flood to half-ebb only, signalized in the day by a black ball; range of light, five leagues. *Greenore Point*, Carlingford, a revolving light at 29 feet; *Balbriggan*, a white tower, with fixed light at 35 feet; seen at 11 miles off: *Howth Harbour*, east pier-head, a white tower, with fixed light, red, at 43 feet; seen at 11 miles: two small lights, as a leading mark, on the western pier-head.

POOLBEG, end of South wall, Dublin, a stone tower with two fixed lights; the lower from half-flood to half-ebb only; signalized in the day by a black ball; light seen at 13 miles off: *North Wall of Dublin Kay*, a granite tower, with fixed light at 33 feet; seen three leagues off. *East Pier-head of Kingston Harbour*, a brown tower, light revolving, at 31 feet, time, one minute; seen at three leagues.

WATERFORD.—*Dunmore pier-head*, west side of the entrance to Waterford, a white tower with fixed light, red to seaward, and seen at 8 miles: *Duncannon Fort*, East side of the entrance to Waterford, a white tower with two lights, seen at 6 miles off: *Fort Charles*, in Kinsale Harbour, slate colour, fixed light, seen at six miles.

KILCADRAAN POINT, in the Shannon, a white tower, fixed light, at 133 feet; appears red to seaward, bright to the harbour. North end of Tarbert Isle, in the Shannon; a tower with fixed light at 58 feet above high water, obscured landward.

Mutton Isle, *Galway Harbour*, a white tower, light fixed at 33 feet, red seaward, bright landward; seen at 10 miles; *Innisgort in Clew Bay*, a white tower, with fixed light at 36 feet, seen 10 miles off.

SLIGO AND DONEGAL.—In *Sligo Bay* a lighthouse on the *Black Rock*, with fixed light at 74 feet, seen at more than four leagues: also two lights, fixed, on *Oyster Isle*, within the entrance of the harbour, respectively at 43 and 53 feet above the sea, in a line bearing S.S.E. $\frac{3}{4}$ E. *St. John's Point*, on the north side of Donegal Bay, a white tower, with fixed light, at 104 feet: range more than four leagues. On *Rotten Isle*, *Killybegs Harbour*, 3 miles N.E. $\frac{1}{4}$ N. from *St. John's Point*, a white tower, with fixed light at 67 feet. For *Fannet Point*, Lough Swilly, see above.

Light-vessels. At the north end of the Kish Bank, off Dublin Bay, with three lights at 25 feet; seen at 9 miles. At the south end of the Arklow Bank, with one light, seen at 8 miles: *Coningbeg or Saltees*, with two lights, seen more than two leagues; a flag by day, and bell in thick weather.

4. FRANCE, &c.

	LATITUDE.			LONGITUDE.			AUTHORITIES.
NORTHERN COAST.	°	'	"	°	'	"	
PARIS; <i>Royal Observatory</i> [1.]	48	50	14	2	20	22 E.	Originally from the triangles intended merely for the admeasurement of the degrees of the meridian in France, but ultimately carried on throughout the
Antwerp, or Anvers [2.]	51	13	16	4	24	19 —	
Vlissingen, or Flushing	51	26	42	3	35	6 —	
Ostende	51	13	57	2	55	17 —	
Nieuport	51	7	54	2	45	24 —	
DUNKIRK; [Dunkerque] Lt-house	51	1	59	2	22	55 —	

FRANCE CONTINUED.

	LATITUDE.			LONGITUDE.			AUTHORITIES.
	°	'	"	°	'	"	
Calais; Light-tower	50	57	32	1	51	25 E.	kingdom. These were commenced by M. Picard, who effected an admeasurement between Paris and Amiens in 1669, and finally completed by Messrs. Mechain and Delambre, in 1798; after having exercised the abilities and industry of M. Cassini the elder, his son, and grandson; and of MM. Miraldi and De la Caille, with other of the most eminent French astronomers, &c., to the present time.
Boulogne; Light, W. Jetty head	50	43	45	1	35	24 —	
Point d'Alprec; Light	50	42	0	1	33	44 —	
Etaples; Lornel Light	50	32	30	1	35	24 —	
Touquet Lights	50	31	0	1	35	54 —	
Cayeux; Lighthouse	50	11	30	1	30	24 —	
Treport; Tide-light	50	4	45	1	22	34 —	
DIEPPE; Tide-light	49	55	40	1	5	14 —	
L'Ailly; Lighthouse	49	55	7	0	57	44 —	
St. Valery en Caux; Tide-light ..	49	52	40	0	43	14 —	
Fécamp; Tide-light	49	45	50	0	22	24 —	
LA HEVE; High-light	49	30	40	0	4	34 —	
Havre; Harbour-light	49	29	0	0	6	39 —	
Quillebœuf; Harbour-light	49	28	30	0	31	44 —	
Honfleur; Upper-light	49	25	25	0	14	14 —	
Mouth of the Orne; Upper-light	49	16	35	0	15	6 W.	
Barfleur; North jetty head-light..	49	40	14	1	15	26 —	
Cape Barfleur or Point Gatteville;							The excellent Surveys of the Coast by the French Engineers, under the direction of M. Beautemps Beaupré, 1830, 1831, and according to which the charts have since been corrected.
Lighthouse	49	41	52	2	20	46 —	
Cherbourg; Pelée-light	49	40	16	1	34	51 —	
Granville; Lighthouse	48	50	7	1	34	37 —	
CAPE FREHEL; Lighthouse	48	41	5	2	19	3 —	
Le Robinet, Islet	48	40	33	2	26	40 —	
Cape d'Erqui	48	38	45	2	19	15 —	
Les Comtesses; Western rock ..	48	38	50	2	34	23 —	
Grand Lejon (Rock)	48	45	0	2	39	50 —	
Harbour Isle, off St. Quay	48	40	2	2	48	22 —	
Isle Brehat; N.E. point	48	51	54	2	59	0 —	
Héaux de Brehat; Lighthouse ..	48	54	37	3	5	12 —	
Les Sept Iles; Lighthouse	48	52	46	3	29	20 —	
Isle de Bas; Lighthouse near the west end	48	44	45	4	1	29 —	
OUESANT or USHANT; Lighthouse	48	28	30	5	2	27 —	
The BAY of BISCAY.							
Lampaul	48	33	40	4	38	18 —	The HYDROGRAPHIC SURVEYS of the Western Coasts of France, made under the direction of M. BEAUTEPS BEAUPRÉ; an Exposition of which, by M. Daussy, was published at Paris, by authority, in the years 1829—1839.
St. Mathieu; Lighthouse	48	19	49	4	45	19 —	
BREST; St. Louis	48	23	20	4	28	27 —	
Bec du Raz; Lighthouse	48	2	22	4	42	50 —	
Ile de Sein; Lighthouse	48	2	40	4	50	56 —	
Penmarc'h; Lighthouse	47	47	53	4	20	22 —	
Penfret; Lighthouse	47	43	17	3	56	14 —	
Ile de Groix; Western Lighthouse	47	38	55	3	29	28 —	
Port Louis; St. Pierre	47	42	31	3	20	21 —	
Belle Isle; Lightho. on S.W. Point	47	18	40	3	13	31 —	
Isle Hædic; Lighthouse	47	20	32	2	52	0 —	
Le Four; Lighthouse	47	17	53	2	37	56 —	
Aiguillon; Lighthouse	47	14	33	2	15	39 —	
Pilier; Lighthouse	47	2	36	2	19	32 —	
Ile d'Yeu; Lighthouse	46	43	5	2	22	47 —	
St. Gilles sur Vie	46	41	46	1	55	1 —	
Sables d'Olonne; Lighthouse	46	29	39	1	46	46 —	
Isle de Ré; Baleine Lighthouse..	46	14	47	1	32	45 —	
—; Port of St. Martin ..	46	12	12	1	21	7 —	

FRANCE CONTINUED.

	LATITUDE.	LONGITUDE.	AUTHORITIES.
Rochelle; Harbour Light	46° 9' 21"	1° 8' 27" W.	The HYDROGRAPHIC SURVEYS of the Western Coasts of France, made under the direction of M. BEAUTEUPS BEAUPRÉ, &c.
Oleron; Chassiron Lighthouse ..	46° 2' 49"	1° 23' 43" —	
Isle of Aix; Harbour Light	46° 0' 36"	1° 9' 42" —	
Point de la Coubre; Light	45° 41' 37"	1° 13' 6" —	
Port of Royan; Light	45° 37' 50"	1° 0' 39" —	
Cordouan Lighthouse	45° 35' 11"	1° 9' 26" —	REMARKS. There appears to be a difference in longitude between the former triangulation and the new surveys, varying from about 30 to 50 seconds, which cannot be exactly accounted for: the new giving the longitudes less by about that quantity.
Pauillac; Harbour Light	45° 11' 58"	0° 43' 57" —	
BORDEAUX; W. point of St. André	44° 50' 16"	0° 33' 42" —	
Point de Grave; Lighthouse	45° 34' 29"	1° 3' 46" —	
Beacons East of Capbreton	43° 39' 26"	1° 25' 31" —	
La Teste de Buch	44° 37' 57"	1° 8' 0" —	
Signal tower of the River Adour	43° 31' 36"	1° 29' 53" —	
Bayonne	43° 29' 26"	1° 27' 44" —	
Biarritz; Lighthouse	43° 28' 28"	1° 32' 25" —	
Socoa; Harbour Light	43° 23' 44"	1° 40' 14" —	

NOTES.

1. PARIS.—The grand operations, in point of accuracy, for the determination of the length of the degrees of the meridian, have taken place since 1783. In that year a memorial was transmitted by M. Cassini de Thury to the Right Hon. Charles James Fox, then Secretary of State, showing the advantages that astronomy would derive from the construction of a series of triangles, that should connect, trigonometrically, the observatories of Greenwich and Paris, and thus correctly determine their relative positions.

This application caused the operations by General Roy, already explained, which have since extended into a General Survey. This gentleman, in England, acted in conjunction with Messrs. Cassini, Mechain, and Legendre, in France; but, it unfortunately happened that the results of the two parties did not exactly agree; that of the British officers, being, for the difference of longitude, $2^{\circ} 19' 51''$, while that of the French was $2^{\circ} 20' 15''$.

In order to determine this question, the subject was resumed in 1821, on the suggestion of the French authorities. The operations have consequently been repeated, under the direction of commissioners, nominated, respectively, by the Academy of Sciences and the Royal Society: An account of the operations and results have been given in the 'Transactions' of the latter, and the final determination is, that $2^{\circ} 20' 22''$ is the difference between the meridians of Paris and Greenwich. This, of course, is now adopted, as shown in the Table.

VARIATIONS OF THE COMPASS.—The Variation at the Isle of Brehat, in 1831, was found to be $24^{\circ} 49'$ W.: at Ushant it is about 26° . The variations as given by the surveyors under M. Beaupré, in 1829, were as follow:—

At Crozon, in latitude $48^{\circ} 14' 48''$, $25^{\circ} 7'$ W.: L'Orient, $24^{\circ} 28'$: Noirmoutier, 24° : Isle d'Yeu and Sables d'Olonne, $23^{\circ} 42'$: Anchorage of Aiguillon, $23^{\circ} 6'$: Baleine Lighthouse, $23^{\circ} 10'$: Rochelle, $23^{\circ} 6'$: Isle d'Aix and Rochefort, $22^{\circ} 59'$: Cordouan Lighthouse, $22^{\circ} 30'$: Bassin d'Arcachon, $22^{\circ} 23'$: St. Jean de Luz, River Adour, &c. $22^{\circ} 19'$.

In $46^{\circ} 24'$ and $10^{\circ} 15'$, the Baron Roussin found it 25° W. in 1823. For some remarks on Basque Roads, &c., by Captain Smyth, see Section III. hereafter.

LIGHTHOUSES, &c. on the FRENCH COAST.

PRINCIPAL LIGHTHOUSES.—*Lights not otherwise described are of the brilliant or natural colour. (Bearings by compass.)*

* * In this description the heights of the Lights are given from the level of the sea at high water of the equinoctial or highest spring-tides. The lengths or distances to which the lights may be seen, in clear weather, are given in marine leagues: and they are estimated in supposing the observer to be placed at certain distances above the surface of the sea, as to a simple harbour light, a light of the third, of the second, or of the first, order: always excepting old lights, which are too weak to be seen to the limit of the horizon corresponding with their height, and of which the mean ranges of light have been deduced from actual observation.

DUNKIRK; Heuguenar tower, fixed light at 82 feet. Range of light, more than four leagues. Also a tide-light, as shown hereafter.

CALAIS; on the central tower, a revolving light, at 124 feet; time, light 30 seconds, dark one minute. Seen at more than six leagues. Also a tide-light.

CAPE GRISNEZ, in latitude $50^{\circ} 52' 10''$, east longitude $1^{\circ} 33' 9''$. Fixed light at 193 feet, seen at seven leagues.

A smaller building exhibits a light at 26 feet lower than the high light, from which it is 55 yards distant to the W.N.W. This lower light is varied by a flash once in every three minutes, and visible at only half the distance of the high light.

Cape or Point d'Alprez, on the tower of an old semaphore, a fixed light at 154 feet. Seen at $3\frac{1}{2}$ leagues.

Point de Berck, near the River Authie, latitude $50^{\circ} 23' 50''$; a fixed light at 56 feet; range of light, three leagues.

Cayeux, near the entrance of the Somme, latitude $50^{\circ} 11' 30''$: light at 91 feet, varied by flashes of 8 to 10 seconds, succeeding each other once in every four minutes. Visible 5 leagues off.

Cape L'Ailly; tower with revolving light at 305 feet, eclipsed every 80 seconds. Range of light 6 to 7 leagues.

Fecamp; a fixed light, of the first class, on the Mont de la Vierge, to the left of the entrance of the port, at 427 feet above high water. Range between six and seven leagues. Also a tide-light, as noticed hereafter.

CAPE LA HEVE; one league to the N.N.W. of the port of Havre, in latitude $49^{\circ} 29'$; two towers, 206 feet apart, with fixed lights at 440 feet. Seen at seven leagues. In a line nearly N.E. and S.W.

Point de Ver, four leagues westward from the mouth of the Orne; light at 137 feet, varied by a flash every four minutes. Range, five leagues.

CAPE BARFLEUR; tower with double or intermittent light at 236 feet, a flash every half minute; seen at seven leagues; but the eclipses are not total within three leagues.

Cherbourg.—Central fort on the Dike, a tower with revolving light at 65 feet: each flash lasts 4 or 5 seconds, and is followed by a short eclipse; a faint light then appears for $2\frac{3}{4}$ minutes, and after another short eclipse, another flash, &c. Range 3 leagues. See, further, 'Harbour-Lights,' hereafter.

Cape La Hague.—On the rock called the Gros du Raz, in latitude $49^{\circ} 43' 22''$, a tower with fixed light of the first order, at 157 feet above high water. Range between 6 and 7 leagues.

CASKETS; three stone towers, forming a triangle, with revolving lights at 120 feet. Upon certain bearings they appear as two only. The N.E. and S.E. towers in one bear S.W. by W. Time, 15 seconds: Range about six leagues.

Cape Carteret, lat. $49^{\circ} 22' 27''$; a tower with intermittent light at 262 feet. A flash every half minute. Range, six leagues; eclipses not total within $2\frac{1}{2}$ leagues.

Granville; tower on Cape Lihou, with fixed light at 154 feet; range, five leagues.

CAPE FREHEL; tower with revolving light at 246 feet, eclipsed every $2\frac{3}{4}$ minutes. Range, seven leagues.

Héaux de Bréhat; on the highest rock, at $4\frac{1}{2}$ miles northwestward from the Isle Bréhat, a provisional fixed light, seen in 1839 at three leagues off, but to be succeeded by a permanent one, to be seen at 6 or 7 leagues.

Les Sept Isles; on the eastern extremity of the Ile aux Moines, a light at 167 feet, varied by a flash once in three minutes, which lasts from 4 to 5 seconds. The fainter light, seen during the intervals, is immediately preceded and followed by very short eclipses. Range of light, $3\frac{1}{2}$ leagues.

Isle de Bas; a tower upon the western part, in lat. $48^{\circ} 44' 45''$, with double or intermittent light at 223 feet; a flash once in a minute. Flashes seen at 8, and eclipses not total within 4, leagues.

Ouessant or Ushant; on the N.E. part of a lighthouse of the first order, with fixed light at 265 feet. Range of light between 6 and 7 leagues.

as shown on the map, was mistaken for Dunkirk—

BAY OF BISCAY.

Point St. Mathieu, lat. $48^{\circ} 19' 49''$; a tower with revolving light at 177 feet; eclipsed every half minute. Perceptible at six, and eclipses not total within $2\frac{1}{2}$ leagues.

CHAUSSEE de SEIN or *Saintes*, the chain of rocks extending $14\frac{1}{2}$ miles from the coast westward. A tower on the northern point of the *Ile de Sein*, in lat. $48^{\circ} 2' 40''$, long. $4^{\circ} 50' 56''$; flashing or intermittent light at 148 feet: Flashes every 4 minutes, preceded and followed by short eclipses, but not total within three leagues. The weaker light, which continues about three minutes between the flashes, visible about six leagues.

Bec du Raz, in lat. $48^{\circ} 2' 22''$, long. $4^{\circ} 42' 50''$; a fixed light at 259 feet: visible six leagues. From this light-tower that of the *Sein* bears N.W. $\frac{1}{2}$ W. (by comp.) $5\frac{1}{2}$ miles. This bearing is the general direction of the whole chain of rocks, called the *Chaussée de Sein*, and passes about 4 cables' length to the southward of the north-western extremity of the chain, which is 9 miles from the *Sein* light, and $14\frac{1}{2}$ from that on the *Bec du Raz*.

In approaching these rocks from the westward, the first light seen will be the flashing light on the *Isle de Sein*; and a single bearing of it will indicate to the mariner whether he is to the northward or southward of the two lights. In clear weather the *Bec du Raz* light will not be seen till the vessel is within 4 or 5 miles of the western extremity of the chain of rocks. (See further our *Directory for the Bay of Biscay*, 1839, p. 4.)

Penmarc'h or *Penmark*; on the point, in lat. $47^{\circ} 47' 53''$, long. $4^{\circ} 20' 22''$, a revolving light of the first class, with eclipses every half minute, at 134 feet. Range of light, seven leagues. In ordinary weather the eclipses do not appear total within three leagues.

Ile de Penfret, one of the *Glenan* Islands. A tower, near the north point, in lat. $47^{\circ} 43' 17''$; with a light of the third order, varied by a flash once in four minutes, as in the *Ile de Sein*, described above. Elevation, 118 feet. Flashes last from 8 to 10 seconds. The weaker light, between the flashes, preceded and followed by short intervals of darkness, seen at five leagues.

Isle de Groix; tower on the N.W. point, in lat. $47^{\circ} 38' 55''$, with fixed light at 170 feet, seen at six leagues. On the eastern point, a fixed harbour-light, at 154 feet, seen at three leagues.

BELLE ISLE; on the S.W. point, lat. $47^{\circ} 18' 40''$, a tower with intermittent light at 276 feet; eclipsed once a minute. Flashes perceptible at 8, and eclipses not total within 4, leagues. *Isle of Hædic*; see Harbour-Lights.

Le Four; a stone tower, on the northernmost rocks, with revolving light at 55 feet; eclipsed once a minute, and seen at five leagues.

River Loire; *Tour du Commerce*, flash every three minutes, at 127 feet; *Tour d'Aiguillon*, fixed light at 111 feet. Seen, respectively, at 5 and $5\frac{1}{2}$ leagues. In a line, N.E. by E.

Peliet, near the N.W. point of *Noirmoutier*; a tower, with light and flash once in four minutes, at 105 feet. Seen at six leagues.

Isle d'Yeu, N.W. point of; tower, with fixed light at 177 feet. Range between six and seven leagues. *Port Breton*; see Harbour Lights.

Sables d'Olonne; see Harbour Lights, hereafter. Range, $3\frac{1}{2}$ leagues.

N.W. End of Ré; *Tour de Baleines*, with revolving light at 95 feet; eclipsed every minute and three-quarters. Brilliant flashes, stronger and weaker alternately. Seen at six leagues.

North End of Oleron; *Tour de Chassiron*, fixed light, at 164 feet. Range, six leagues.

Mouth of the Gironde; *Tour de Cordouan*, revolving light, at 206 feet; time, one minute. Flashes, stronger and weaker alternately. Eclipses not total within three leagues. Seen at nine leagues.

Cape Ferret, the north point of the *Bassin d'Arcachon*, lat. $44^{\circ} 38' 43''$; a tower, with fixed light, to be seen at the distance of six leagues. (*Building in 1839.*)

Biarritz, near *Bayonne*; tower on *Point St. Martin*; intermittent light; time, half a minute; not totally eclipsed within four leagues. Seen at seven leagues.

REMARKS.—The TOWER or LIGHTHOUSE of *CORDOUAN*, at the mouth of the *Gironde*, is the most elegant structure of the kind existing. It was the work of *Louis de Foix*, a French architect, was twenty-six years in building, and completed in the reign of *Henry IV.*, 1611. Its original height was 169 French feet; but, in 1727, the upper part being calcined, an iron lantern was erected, which increased its height. When lighted with coal, it consumed 225 pounds every night; but the light is now from lamps, with lenses on the new principle, revolving, and of great brilliancy. This light now appears in its full lustre once in a minute, as shown above.

HARBOUR AND TIDE-LIGHTS.

DUNKIRK western jetty, a fixed light, which, in a line with the high light, leads into the harbour; height 23 feet; seen at two leagues. *Calais*, on *Fort Rouge*, west of the entrance, a tide-light, with 8 feet between the jetties: *Boulogne*, on a scaffold upon the N.E. jetty, a red light at 16 feet above high water, seen at $4\frac{1}{2}$ miles; and two lights on a mast upon the head of the S.W. jetty, at 39 and 29 feet; seen at five miles; of these the upper is lighted at the

the moment of half flood and continued to half ebb, while the lower denotes the moment of high water. The red light is kept in during the same time as the upper light. *Etaples*, on the north point of the entrance, a fixed light; on the south point two others; seen at 2 and $2\frac{1}{2}$ leagues. *St. Valéry sur Somme*, at Cayeux, against the southern passage, a tower, with intermittent light, described with the principal lights above. *Treport*, a tide-light, on the western jetty, with six feet of water in the channel; seen at three leagues.

DIEPPE, a tide-light on the western jetty, at 39 feet, visible three leagues, while there are $10\frac{1}{2}$ feet of water in the passage. Three lanterns, attached to a mast, at 32 feet from the extremity of the eastern jetty, mark its situation by night; viz. a fixed light is kept up during the night, at 22 feet above high water: one tide-light is placed about 8 feet above this permanent light, at $2\frac{1}{2}$ hours before high water; and a second tide-light between the two preceding, at two hours before the same; these are extinguished at the moment of high water, and two hours before the superior light: but they are not lighted when the state of the sea prevents an access to the port.

St. Valéry en Caux; a tide-light on the western jetty, with 8 feet of water in the channel, seen at two leagues.

Fécamp; fixed light on the Mont de la Vierge, described with the principal lights above. A tide-light on the northern jetty, at the foot of the mountain, elevated 39 feet, shows a flash once in three minutes, seen at three leagues, and denotes 10 feet of water in the channel.

PORT OF HAVRE; on the northern jetty a fixed light at 22 feet, seen at $2\frac{1}{2}$ leagues. Within the Seine, on different points, are fourteen harbour lights, which have been established since the 1st of May, 1838, exclusive of those of *Honfleur*, next described. At *Honfleur* is a fixed harbour-light on the jetty, at the N.W. extremity of the town, and one on the quay, north of the new basin; both seen at three leagues.

Mouth of the Touque, lat. $49^{\circ} 21' 30''$; two lights in the direction of the channel, seen at two leagues; the one permanent, and the other a tide-light, while there are seven feet at the entrance. *Mouth of the Orne*, two fixed lights at 91 and 39 feet, leading into the channel; seen at 2 and $2\frac{1}{2}$ leagues. *Corseule*, $9\frac{1}{2}$ miles westward from the Orne; fixed light on the western jetty, at 30 feet; seen at two leagues. *Point de Ver*, intermittent light described above. *Port au Bessin* and *Grand Champ*, temporary lights for the fishermen. *Port of La Hogue*, three harbour-lights fixed, as described in the Channel Directory; seen at three leagues. *Port of Barfleur*, two fixed lights, at 32 feet, leading to the harbour, and seen at $4\frac{1}{2}$ miles.

CHERBOURG; Light-tower on the centre of the Dike, already described; also one on Fort Querqueville, to the west, and two on the isle Pelée to the east; seen at three and two leagues; on the eastern jetty of the port, a red light.

GUERNSEY, on the Round-house of the south pier-head of *St. Pierre*, a gas light, at 40 feet; very useful as a mark through the Little Russel and other channels. *Port of Granville*, on the S.E. extremity of the new mole, larboard side in entering, a fixed light, at 26 feet, seen at $3\frac{1}{2}$ miles.

BAY OF BISCAY.—*Palais*, in Belle Isle; on the great mole, upon the left of the entrance, a fixed light, seen at $3\frac{1}{2}$ miles. On the *Isle Hadic*, a light, fixed, at 35 feet; range, three leagues. *Entrance of the Vilaine*, on the north point, a fixed light, at 52 feet, seen at three leagues. *Port of Croisic*, two lights, in a line, leading to the port, seen at one league. *St. Nizaire*, within the Loire, a fixed light; range seven miles.

Port Breton, in the Isle d'Yeu, two fixed lights, leading to the harbour, seen at two to three leagues. *St. Gilles*, to the E.S.E. of Isle d'Yeu, a tide-light to show when vessels may enter. *Sables d'Olonne*; a light-tower on the Quay of *La Chaume*, and a harbour-light on the head of the jetty, lead to the harbour. The light on the Quay is fixed, at 118 feet; and may be seen at $3\frac{1}{2}$ leagues off. The lower light, at 23 feet only, is seen at two leagues. *Pertuis Breton*; on the point of Grouin du Cou, the north point of the entrance, a fixed light, at 59 feet, seen at $3\frac{1}{2}$ leagues; on the point of *Eguillon*, 10 miles more to the S.E., a fixed light, at 32 feet; seen at nearly three leagues. *St. Martin's*, Isle of Ré, fixed light, on the east side of the entrance, at 39 feet; seen at two leagues. *La Rochelle*, fixed light, on the left of the entrance, at 46 feet; seen at three leagues. *Isle d'Air*, a fixed light, on the south point, at 55 feet; seen at $2\frac{1}{2}$ leagues. *Point de la Coubre*, on the north side of the mouth of the Gironde, a fixed light, at 36 feet; seen at three leagues off.

Royan, at $11\frac{1}{2}$ miles to the S.E. of La Coubre, a fixed light, at 36 feet; seen at two leagues. *Point de Grave*, on the south side of the mouth of the Gironde, a wooden tower, with fixed light, at 59 feet; seen three leagues. *Pauillac*, on the western shore of the Gironde, a fixed light, at $19\frac{1}{2}$ feet; seen at two leagues. *Socoa*, on the west side of the entrance of the port of *St. Jean de Luz*, a fixed light, at 98 feet, seen at $2\frac{1}{2}$ leagues.

5. SPAIN AND PORTUGAL.

	LATIT. N.	LONG. W.	AUTHORITIES.
MADRID; Grand Place[1.]	40° 24' 57"	3° 41' 36"	These Positions of Places in Spain and Portugal are given on the authority of Don VINCENTE TOFINO, and Don JOSEF VARELA, of the Spanish Marine, and of Major FRANZINI, of the Portuguese Royal Engineers; whose valuable charts and observations have been made use of in the delineation of the coasts. It is, nevertheless, to be noticed, that we have, both in this Table and in the Chart, adopted some subsequent emendations received through the medium of the <i>Connaissance des Temps</i> , &c.
Fontarabia	43° 21' 46"	1° 46' 32"	
Cape Higuera; Light.....	43° 23' 25"	1° 46' 42"	
St. Sebastian; Lighthouse..	43° 19' 18"	1° 58' 39"	
Cape Machichaco ..	43° 28' 0"	2° 39' 48"	
Portugalete	43° 20' 10"	2° 58' 20"	
Santander; Lighthouse on Cape Mayor	43° 30' 10"	3° 39' 52"	
Cape Penas; Islet	43° 42' 16"	5° 46' 40"	
Ribadeo; Entrance of the Harbour	43° 34' 45"	6° 59' 40"	
Vivero; Entr. of the Harbour	43° 43' 45"	7° 32' 45"	
Point de la Estaca	43° 47' 50"	7° 38' 50"	Captain <i>Edw. Belcher</i> , in 1833, on his Survey of the Douro, made the Fort of St. João da Foz, on the north side of the entrance, 41° 8' 48" N., and 8° 37' W.
Cape Ortegal	43° 46' 40"	7° 50' 30"	
Cape Prior	43° 34' 15"	8° 12' 45"	
Ferrol; Entr. of the Harbour	43° 28' 0"	8° 15' 15"	
Corunna; Lighthouse	43° 23' 36"	8° 19' 35"	
Cisargas Isles, off Cape St. Adrian	43° 22' 15"	8° 47' 30"	
Cape Villano	43° 11' 20"	9° 10' 20"	
Cape Toriana	43° 3' 0"	9° 17' 0"	
CAPE FINISTERRE.....	42° 54' 0"	9° 16' 15"	
Vigo	42° 13' 20"	8° 39' 45"	
Caminha, at the Entrance of the Minho	41° 52' 42"	8° 44' 30"	REMARKS. Since the publication of our first Edition, we have been favoured by Capt. William Henry Smyth, of the Royal Navy, with a series of determined points, previously given by Tofino, &c., as shown in the Table. They were settled by this gentleman, when a lieutenant, in 1811 and 1812, by lunar and chronometric observations. We prefer giving both, because it affords a mean of estimating the respective value of each. The points given by Captain Smyth, distinguished by asterisks (*) in the Table, are as follow : Oporto, 41° 10' 30" N., 8° 37' 18" W. : Cape Mondego, 40° 13' 30" N., 8° 52' 45" W. : Cape Roca, 38° 46' 15" N., 9° 25' 10" W. : Lisbon, 38° 42' 35" N., 9° 5' 50" W. : Cape Espichel, 38° 25' 30" N., 9° 10' 0" W. : Cape St. Vincent, 37° 2' 10" N., 9° 1' 10" W. : Lagos, 37° 8' 40" N., 8° 37' 45" W. : Cape St. Mary, 36° 57' 0" N., 7° 54' 30" W. : Chipiona, 36° 43' 50" N., 6° 24' 30" W. : Cadiz, 36° 32' 28" N., 6° 17' 30" W. : St. Sebastian Light, 36° 31' 10" N., 6° 18' 50" W. : Tariffa, 36° 0' 50" N., 5° 36' 15" W. : Gibraltar, 36° 6' 30" N., 5° 21' 12" W.
Villa do Conde [2.]	41° 21' 20"	8° 36' 42"	
Porto or Oporto, the Bar of*	41° 10' 15"	8° 38' 0"	
Aveiro, the Bar of	40° 38' 30"	8° 41' 0"	
Cape Mondego*.....	40° 12' 30"	8° 53' 48"	
Nazareth; the Church	39° 36' 36"	9° 4' 45"	
Berlengas or Borlings (<i>Mid. of the greatest</i>)	39° 24' 40"	9° 31' 11"	
Peniche, or Cape Carboeiro.	39° 21' 20"	9° 24' 0"	
Cape Roca, or Rock of Lis- bon; * Lighthouse	38° 46' 30"	9° 29' 56"	
LISBON, OBSERVATORY[3.]	38° 42' 40"	9° 8' 30"	
Cape Espichel, or Spichel ..	38° 24' 54"	9° 13' 0"	F
Bar of Odemira	37° 39' 0"	8° 50' 0"	
Cape St. Vincent*	37° 2' 54"	9° 0' 54"	
Lagos*	37° 8' 0"	8° 37' 45"	
Cape Santa Maria, or St. Mary*.....	36° 55' 36"	7° 49' 12"	
Monte Figo (<i>height</i> 2000 ft.)	37° 9' 42"	7° 42' 30"	
Point Chipiona, * Entrance to St. Lucar	36° 44' 18"	6° 24' 15"	
CADIZ; OBSERVATORY*[4]	36° 32' 0"	6° 17' 30"	
St. Sebastian Lighthouse ..	36° 31' 10"	6° 18' 42"	
Cape Trafalgar	36° 10' 15"	6° 1' 30"	
Isle of Tariffa; * Lighthouse	36° 0' 50"	5° 36' 10"	NOTES.
GIBRALTAR; Europa Pt.*[5.]	36° 6' 20"	5° 19' 46"	

NOTES.

1. GENERAL NOTE.—The Charts of the Coasts of Spain and Portugal have heretofore been regulated chiefly by the observations made by *M. Bory*, some of whose results approached very nearly to those which we have given; as of Cape Finisterre, $42^{\circ} 51' 52''$, long. $9^{\circ} 18' 25''$; but others deviate considerably. The whole, as now given, have, however, been modified by the latest and most authentic observations, and there is reason for believing that no error, of material consequence, will hereafter be found.

For a more particular detail, see the new Chart of Spain and Portugal, with the harbours, &c., on an enlarged scale, constructed by the Editor, and published by the Proprietor, of this work.

2. VILLA DO CONDE, Sept. 1833.—H.M.S. *Orestes* had struck on a sunken rock, previously unknown, off the town of *Villa do Conde*; the bearings from the rock were, the north part of the town E. $\frac{1}{2}$ N.; the south part E. $\frac{1}{2}$ S., distance upward of three miles.

3. LISBON.—The longitude of Lisbon had been previously assumed as $9^{\circ} 8' 40''$, being a mean result of observations made by the astronomers *De la Caille*, *Pingré*, and *Messier*, according to a great number of eclipses of the first satellite of Jupiter. The occultation of a star by the moon, Oct. 5, 1753, with a corresponding one at Paris, gave one minute more. Captain *Fitzwilliam Owen*, in the Memoir of his important expeditions to Portugal and Africa, assigns to the Arsenal of Lisbon $38^{\circ} 42' 18''$ N. and $9^{\circ} 8' 54''$ W., from observations made in H.M.S. *Leven*, in 1819 and 1822.

4. CADIZ.—The position of the observatory, in the city of Cadiz, is established as $36^{\circ} 32' 0''$ N., and $6^{\circ} 17' 30''$ W. The new observatory (*Real Observatorio*) of San Fernando, in the Isle of Leon, is in $36^{\circ} 37' 43''$ N., and $6^{\circ} 12' 16''$ W.

The port of Cadiz was established as a free port, for the vessels of all nations, in the early part of the year 1829; and, in consequence, many English houses from Gibraltar soon removed hither, or established a branch house here; so that our trade with Cadiz soon became more extensive than with Gibraltar. (Sept. 1830.)

5. GIBRALTAR, &c.—Mr. Charles Rumker gives the position of Europa Point, Gibraltar, as $36^{\circ} 5' 15''$ N. and $5^{\circ} 20' 15''$ W.: of Alboran Isle, as $35^{\circ} 56'$ N. and $3^{\circ} 3'$ W.: and of Cabrera, as $39^{\circ} 7'$ N. and $2^{\circ} 59' 15''$ W. *Edinburgh Phil. Journal*, Vol. I. p. 322. The late Captain Bauza, of the Hydrographic establishment at Madrid, gave Tariffa in $36^{\circ} 0'$. This accords with Mr. Rumker; but Captain Livingston made the latitude of Europa Point, by sextant and artificial horizon, in 1820, $36^{\circ} 6' 10''$, and exactly the same on another day by the sea-horizon. Captain Smyth has given Gibraltar in $36^{\circ} 6' 30''$, and $5^{\circ} 21' 12''$.

For the positions of places within the Strait, see our "*New Directory for the Mediterranean Sea*."

VARIATIONS OF THE COMPASS.—Captain Smyth found the variation off Portugal, in latitude $38^{\circ} 2'$, long. $14^{\circ} 34'$, to be 23° W. in 1804; and, in 1833, Captain Edw. Belcher, at the mouth of the Douro, found it to be $23^{\circ} 45'$ W.

LIGHTHOUSES, &c.—SPAIN AND PORTUGAL.

ST. SEBASTIAN.—The old light on *Mount Igueldo*, upon the western side of Port St. Sebastian, has been discontinued, and a new one has been established on *Mount Orgullo*, upon the eastern side, which is to be lighted during the winter months, from September 14 to May 3. The light is *fixed*, at 205 feet above the level of the sea, and may be seen from the distance of five leagues.

SANTANDER.—A light-tower on Cape Mayor, which forms the western side of the entrance of the harbour of Santander, was completed and first lighted in August, 1839. The lights are 330 feet above the level of the sea; the upper and lower parts fixed, the intermediate revolving or intermitting once in a minute. Flashes, in clear weather, seen more than seven leagues off. By an eye, elevated 40 feet above the sea, they have been seen at nine leagues.

With the *Vientor de Travesia*, or wind upon the beam, or in gloomy weather, be cautious of not mistaking the distance on approaching the coast.

CORUNNA.—The tower of Hercules, the ancient Lighthouse of Corunna, having three sides only,

only, is surmounted by a modern lantern, which exhibits a revolving light, the light and shade of which are of equal duration. Seen at eight leagues off.

OPORTO.—Lighthouse, with fixed light, on a hill at four cables' to the north (by compass) of St. João de Foz: when bearing N.E. by E. $\frac{1}{4}$ E. it leads unto the bar in seven and six fathoms, until the river is open.

LISBON HARBOUR.—There is a tower lighted by night on *Cape Roca*, or the *Rock of Lisbon*, which is a league and a half to the northward of *Cape Razo*, and three leagues to the north-westward of the Bar. *Cascaes Fort* is a league to the S.E. of *Cape Razo*, and about half way between these is the fixed light of *Ná. Sa. de la Guia*. Cascaes is the residence of the pilots for the port of Lisbon. On *Fort St. Julian*, at the northern extremity of the Bar, is another light, in a tower elevated 120 feet above the level of the sea; and facing this, on the opposite side of the bar, is the *Bugio Fort and Light-tower*, which is 66 feet in height. All this will be clearly understood by referring to our chart of Spain and Portugal, with the accompanying Directory of 1839. The tower of the Bugio now displays a revolving light, eclipsed once in three minutes, at the height of 63 feet. The rest are fixed lights.

CADIZ.—Light-tower of St. Sebastian, on the west point of Cadiz, with three parallel rows of four brilliant lights, making a revolution once in a minute, and so that the intervals of total darkness are of two seconds only. Range of light, more than six leagues.

TARRIFFA, the southernmost point of Spain, a low peninsula, but now distinguished by a tower, with revolving light.

EUROPA POINT, Gibraltar: Of the *Victoria Tower*, on this point, the first stone was laid on the 26th of April, 1838. It was building in 1839. The height of the structure from the base to be 60 feet, crowned by a lantern, 10 feet high, to contain a very powerful light, as shown in our "Sailing Directory for Spain and Portugal," 1839.

6. COASTS OF AFRICA.

	LATIT. N.	LONG. W.	AUTHORITIES.
	° ' "	° ' "	
TANGIER; Centre	35 47 30	5 48 0	Don Vincente Tofiño, with subsequent corrections.
Cape Spartel.....[1.]..	35 47 40	5 54 40	
Arzilla	35 29 30	6 0 0	Captain Washington and Lieut. Smith, R.N. 1830.
El Araiche	35 12 50	6 9 0	
Old Mamora	34 52 30	6 25 0	Capt. T. Boteler, R.N. 1828.
Mehedia	34 18 0	6 36 0	Capt. Washington, R.N. 1830
Faz or Fez	34 6 3	4 58 15	Don Juan Badia y Leblich, otherwise called Ali Bey, 1804.
Mekinez	33 58 30	5 30 0	
Slaa or Salee	34 2 45	6 45 30	Captains Boteler and Washington, 1828 and 1830.
Rabat	34 2 30	6 46 0	
El Mansoria	33 46 10	7 20 0	Capt. Washington and Lieut. Smith, R.N. on the mission to Morocco, 1829, 1830, and the Survey of Lieuts. Wm. Arlett and H. Kellett, in 1835.
Point Fidallah.....	33 44 0	7 23 32	
Dar-el-Beida	33 36 30	7 35 24	Capt. T. Boteler, R.N. 1828.
Azamor	33 17 37	8 15 0	
Mazagan	33 15 0	8 29 0	The Chev. de Borda, 1776.
Cape Blanco; North	33 8 0	8 38 0	
El Waladia	33 48 0	8 48 0	Observations of Lieuts. Arlett and Kellett, R.N. 1835.
Cape Cantin	32 32 27	9 15 50	
Asfee or Saffi	32 18 15	9 12 0	Capt. T. Boteler, R.N. 1828.
MAROCCO; Centre ....[3.]..	31 37 40	7 36 0	
SUERRAH or MOGODOR	31 30 30	9 44 0	Captain T. Boteler, 1828.
Cape Tefelneh.....	31 4 0	9 47 30	
Cape Ghir or Geer	30 38 0	9 53 0	The Chev. de Borda, 1776.
Ras Aferni	30 37 30	9 52 0	
Agadeer or Santa Cruz	30 26 35	9 35 56	Observations of Lieuts. Arlett and Kellett, R.N. 1835.
Cape Aguluh	29 49 0	9 48 0	
Cape Noon or Inoon	28 45 45	11 4 10	The Chev. de Borda, 1776.
River Inoon; Entrance	28 17 0	11 32 0	

COASTS OF AFRICA CONTINUED.

	LATIT. N.	LONG. W.	AUTHORITIES.
Port Cansado; Entrance [4.]	28 2 0	12 14 0	Lieut. Arlett, &c. 1835.
Cape Juby	27 57 50	12 55 0	
False Cape Boiador	26 25 15	14 12 30	
Cape Boiador or Bojador	26 7 2	14 30 34	The Observations of Capt. W. Fitzwilliam Owen, and those of M. le Baron Roussin, compared with those of le Chevalier Borda. (<i>See Note 4.</i>)
Penha Grande; Summit	25 7 6	14 50 53	
Seven Capes; Central Cape	24 41 12	15 0 30	
Angra dos Cavallos	24 8 12	15 36 18	
Rio do Ouro, or Gold River,			
Entr. North point	23 36 18	15 58 30	** In 1830, Captain Belcher, by repeated observations, found Cape Blanco in latitude 20° 46' 26", longitude 17° 4' 10".
Cintra Bay; North Point	23 7 0	16 9 15	
South Point	22 56 36	16 14 10	
Cape Barbas [5.]	22 19 30	16 39 12	H.M.S. <i>Esk</i> , Capt. Purchas, 1826.
Pedra da Gall; Centre	22 12 30	16 48 4	
Cape Corvoeiro [6.]	21 46 44	16 56 40	
Cape Blanco	20 47 0	17 4 36	Latitudes, Capt. Roussin. Longitudes inferred by Chart, and <i>uncertain</i> .
Cape Mirik; the Down	19 25 0	16 32 0	
Tanit Bay; the Down	19 3 48	16 12 20	
Angel's Hillocks; Southern	18 29 30	16 2 0	Captain (now Admiral and Baron) Roussin, in the years 1817 and 1818.
The two Palm-Trees of Port-tandik [7.]	18 18 54	16 2 12	
Down of Red Sand	17 25 0	16 12 0	
Second ditto	16 55 0	16 25 0	Captains Owen and Boteler.
Huts of Inguiagher	16 35 24	16 30 0	
St. Louis, Senegal; flagstaff	16 0 48	16 33 6	
Bar of the Senegal; N. point	15 55 18	16 32 40	Captain Fitzwilliam Owen.
Little Paps, near Cape Verde;			
Northern one	14 56 24	17 6 10	
Cape Verde; extremity	14 44 30	17 32 0	Captains Owen and Boteler.
Almadia Rocks, off C. Verde;			
highest and Westernmost	14 44 29	17 33 30	
Goree; the flag-staff [8.]	14 39 50	17 24 30	Capt. W. F. Owen, R.N. 1824.
Cape Naze, or Nose	14 31 30	17 7 20	
Portudal; Village	14 27 18	17 3 12	
Point Serine	14 18 0	16 56 30	Captain T. Boteler, 1829.
Joal; Town	14 10 0	16 49 45	Captains Owen and Boteler.

RIVER GAMBIA:—

BATHURST TOWN; flagstaff	13 28 0	16 35 18	Survey of the River Gambia, from its entrance to Pisania, by Capt. Richard Owen, R.N. assisted by Messrs. E. O. Tudor and S. M. Mercer, 1826.
Bird Island; flagstaff	13 39 12	16 40 30	
CAPE ST. MARY [9.]	13 30 12	16 41 24	
James Fort	13 9 40	16 22 12	
Tankrowell	13 25 0	16 3 48	
Elephant Isle; West Point	13 26 30	15 20 36	Captain Thomas Boteler, in H.M. sloop <i>Hecla</i> , 1829.
Yamamaroo Town	13 42 0	14 58 30	
M'Carthy's Isle; Fort George	13 33 0	14 45 30	
Pisania, or Pisaneea	13 32 54	14 34 18	
BALD CAPE	13 22 30	16 49 20	
Point St. Pedro	13 7 15	16 48 0	Captain Thomas Boteler, in H.M. sloop <i>Hecla</i> , 1829.
River Souta; Bird Islet	12 43 30	16 49 0	
River Casamanza; North point of the entrance	12 35 20	16 48 0	
Cape Roxo	12 21 0	16 44 40	

COASTS OF AFRICA CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.
Breakers of Falulo; West point	12	5	0	16	38	30	Captains Roussin and W. F. Owen, 1818, 1821, 1826.
Isle of Cayo; South point . . .	11	49	50	16	20	0	
Bissao; Portuguese Fort	11	51	0	15	37	6	
BIJOOGA ISLANDS, &c.							
Papakawa Islet	11	36	30	15	54	12	Survey of the Bijooga Islands and the adjacent coast of Africa, by the Officers of H. M. ship <i>Leven</i> , Capt. W. F. Owen, 1826.
Arcas I.; Centre	11	41	15	15	39	0	
Bolola Town, Rio Grande . .	11	35	0	15	2	18	
Bulama Island; E. end	11	34	42	15	30	24	** In 1830, <i>Captain Belcher</i> , in H.M.S. <i>Ætna</i> , from his observations, made Pullam Island, South end, in 10° 51' 53" N. and 15° 43' 5" W.: the N. end of Alcatraz in 10° 38' 1" N. and 15° 20½' W.: Sandy Isle in 10° 36' 37" N. and 14° 42' 19" W.— <i>Geog. Journal</i> , Vol. II. p. 284, 291, 295.
Bossessamé or Tombelly; North point	11	29	0	15	30	0	
S.W. point	11	19	24	15	32	12	
Gallinha Isle; W. point . . .	11	27	42	15	46	30	Lieut. Austin, in the <i>African</i> , 1827.
N.E. Hog Island; E. point .	11	20	0	15	40	42	
Kanyabac; N.E. point	11	18	4	15	43	0	
—— S.W. point	11	10	12	15	48	12	Captain Roussin.
Orango; S.E. point	11	3	12	15	55	12	
—— West point	11	6	0	16	15	30	
—— South Breaker	10	56	18	15	57	30	Inferred by Chart. (<i>Uncertain</i> .)
Pullam Island; South Point . .	10	51	42	15	45	6	
Alcatraz Islet; Centre	10	37	12	15	26	30	
Conflict Reef; Centre	10	30	0	15	11	0	Lieut. Austin, in the <i>African</i> , 1827.
Rio Nunez; Entr. Sandy Isle .	10	36	0	14	42	18	
—— Rebucko Town	10	57	0	14	21	48	
Cape Verga; Summit	10	18	52	14	21	20	Inferred by Chart. (<i>Uncertain</i> .)
Pongas River; Entrance	10	2	0	14	8	0	
Mount Suzos or Sangaree; Peak	9	34	0	13	38	0	
ISLES DE LOS:—							
Crawford I. Establishment . .	9	27	24	13	48	30	Captain W. F. Owen, in the <i>Leven</i> , 1826; confirmed by himself in the <i>Eden</i> , and by Capt. Purchas, in the <i>Esk</i> , 1827.
Tamara; Arethusa, or N. pt.	9	31	0	13	40	30	
—— West point	9	26	30	13	51	30	
Matacong Island; Centre	9	14	0	13	25	30	Captain W. F. Owen, in the <i>Leven</i> , 1826.
Yelleboa Island; Centre	8	55	42	13	17	45	
Parrot Island; Centre	8	53	0	13	15	0	
CAPE SIERRA LEON; [10.] Extremity	8	30	0	13	18	0	Captain W. F. Owen, in the <i>Leven</i> , 1826.
SIERRA LEON; King Tom's Point	8	30	6	13	14	30	
—— Freetown Citadel	8	29	42	13	14	18	
False Cape; Extremity	8	25	48	13	17	48	Captain W. F. Owen, in the <i>Leven</i> , 1826.
Cape Chilling or Shilling	8	9	30	13	10	12	
Banana Isles; Highest Peak . .	8	5	48	13	16	12	
—— West Point	8	5	0	13	15	12	Captain W. F. Owen, in the <i>Leven</i> , 1826.
Plantain Islands; Gillmorris . .	7	55	12	13	0	12	
—— Bengal Rocks	7	54	36	13	2	48	
Tassa; Extreme Point	7	55	30	13	2	12	Captain W. F. Owen, in the <i>Leven</i> , 1826.
Turtle Isles; North I., Centre .	7	40	48	13	4	18	
Cape St. Anne; Extremity . . .	7	34	0	12	57	0	
Shoals of St. Anne—							
Northern Extremity	7	56	0	(Not ascertained.)			(Not ascertained.)
Southern Extremity	7	31	30				
Western Limit	7	48	0	13	29	0	

COASTS OF AFRICA CONTINUED.

	LATIT. N.			LONGITUDE.			AUTHORITIES.
	°	'	"	°	'	"	
York Isle, in Sherbro' River;							Capt. W. F. Owen, in the <i>Leven</i> .
Huts.....	7	32	0	12	26	42 W.	
Shebar, Sherbro River.....	7	22	48	12	31	30 —	
Boom Kittam River; Forks ..	7	14	24	12	8	36 —	Captain W. F. Owen, in the <i>Eden</i> , 1827; and Capt. Purchas in the <i>Esk</i> , same year. <i>The two Sestros</i> <i>excepted</i> .
Cape Mount; Extremity [11.]	6	44	25	11	21	30 —	
St. Paul's River; Entrance ..	6	22	0	10	37	0 —	
Cape Mesurado; Extremity ..	6	18	30	10	45	18 —	
River Sestros or Sesters	5	34	0	9	19	0 —	
Sinnoa Hill; Eastern summit..	5	4	0	9	5	42 —	
Krou Rock; Centre	4	59	0	8	53	0 —	
Grand Sestros or Sesters	4	39	0	8	6	0 —	Captain W. F. Owen, in the <i>Eden</i> , 1827; and Capt. Purchas, in the <i>Esk</i> , same year.
CAPE PALMAS; Extremity [12.]	4	23	0	7	44	48 —	
Table Hill	4	25	30	7	45	48 —	
Cape Palmas eastward [13.] ..							Captain W. F. Owen, in the <i>Eden</i> , 1827; and Capt. Purchas, in the <i>Esk</i> , same year. <i>Longitude of Accra</i> , by four good chronometers of H.M.S. <i>Dryad</i> , Captain Hayes, in Feb. 1832, 0° 15' 20" W. Lat. 5° 32' 27" N.
Axim; an islet near.....	4	47	42	2	17	30 —	
Cape Three Points; S.E. Cape	4	44	30	2	4	18 —	
(Capt. Purchas)	4	45	0	2	4	12 —	
Dixcove; Fort.....	4	48	0	1	59	12 —	
Elmina Castle	5	5	0	1	22	30 —	
CAPE COAST CASTLE; flag-staff	5	6	0	1	18	12 —	
Mauree or Moree; flag-staff ..	5	7	30	1	12	0 —	
Annamaboe; flag-staff.....	5	10	12	1	7	12 —	
Cormantine; flag-staff	5	10	30	1	5	36 —	
Tantumquerry; flag-staff	5	13	30	0	46	48 —	Captains Owen & Purchas. Capt. Kelly, in the <i>Pheasant</i> Captains Owen & Purchas. Captain B. M. Kelly. Captain Purchas. Captain B. M. Kelly.
—; Extreme point ..	5	12	30	—	—	—	
Devil's Hill; summit	5	18	36	0	39	0 —	
Barracoe; Point	5	29	0	0	24	0 —	
Accra; British flag-staff	5	32	0	0	13	30 —	
(Capt. Purchas)	5	32	0	0	18	12 —	
Ningo; Fort	5	45	0	0	1	48 E.	
Volta River; Entrance	5	47	18	0	42	18 —	
Cape St. Paul	5	44	30	0	52	18 —	
Quitta; flag-staff.....	5	54	36	0	54	18 —	
—.....	5	55	0	0	55	48 —	Capt. Purchas, in H.M.S. <i>Esk</i> , 1827. Captain A. T. E. Vidal, in H.M. sloop <i>Barracouta</i> , 1826. (<i>Longitude of the</i>
Padiana; Town	5	57	42	0	57	18 —	
Little Popoe; Road	6	13	0	1	36	0 —	
Grand Popoe; Road	6	19	0	1	46	0 —	
—.....	6	16	0	1	43	48 —	
Whydah, or Ajuda	6	19	30	2	5	0 —	
(Say 2° 5' E.)	6	19	0	1	59	48 —	
Appee	6	22	0	2	25	0 —	
Porto-Novo; Hill	6	20	0	2	34	0 —	
—; Road	6	19	0	2	34	0 —	
Badagry; Mount	6	24	0	2	43	30 —	Captain A. T. E. Vidal, in H.M. sloop <i>Barracouta</i> , 1826. (<i>Longitude of the</i>
—; Road	6	20	0	2	47	48 —	
Lagos River; Entrance	6	24	0	3	22	0 —	
—End of the Sandy							}
Beach	6	20	0	4	27	0 —	
Benin River; North Point	5	43	0	4	59	48 —	
Rio dos Esclavos.....	5	34	0	5	5	48 —	
Terra Formosa; West Point ..	4	28	0	5	41	30 —	
—Eastern Point... ..	4	19	24	5	54	33 —	}
River Nun or Quorra; the Bar							
(2 fathoms) [14.]	4	15	0	5	55	0 —	

COASTS OF AFRICA CONTINUED.

	LATITUDE.	LONG. E.	AUTHORITIES.
Rio Bento, or Second River ..	4 17 0 N.	6 14 0	<i>Bar of the Quorra, Capt. Wm. Allen, 1833.</i>
Rio St. Nicolas, or Third River	4 18 0 —	6 24 0	
New Calabar River; Foche Point	4 24 0 —	6 59 0	
Bonny River; Rough Corner..	4 25 0 —	7 7 0	Captain Purchas, in the <i>Esk</i> , 1827.
Old Calabar River; East Head	4 30 0 —	8 27 48	
Bimbia Isle	3 57 0 —	9 13 48	
Cape Camaroen	3 53 0 —	9 24 48	
Cape St. John	1 9 40 —	9 18 40	Survey of Captains Vidal and Boteler, 1826.
Corisco Island; Centre	0 54 30 —	9 17 30	
Point Clara, the N.W. point of the Gaboon	0 29 0 —	9 17 15	
Round Corner, S. of the Gaboon	0 16 45 —	9 16 50	
Cape Lopez.....	0 36 0 S.	8 40 24	
AFRICAN ISLANDS.			
FERNANDO PO :			
Cape Bullen; N.extremity..	3 47 25 N.	8 39 24	Captain W. F. Owen, in the <i>Eden</i> , 1827.
Point William; Flagstaff ..	3 45 36 —	8 45 0	
Cape Horatio; N.E.extremity	3 46 15 —	8 54 24	
Cape Vidal; E. extremity ..	3 39 18 —	8 56 18	
Cape Barrow; South Rock..	3 11 30 —	8 40 0	
Cape Eden; S.W. extremity	3 15 30 —	8 25 6	
Cape Badgley; W. extremity	3 19 42 —	8 24 42	
Charles'Folly; N.W.extremity	3 26 48 —	8 27 42	
Goat Isle; Centre	3 31 0 —	8 32 48	Captains Purchas and Kelly.
PRINCES' ISLAND; the Brothers near	1 23 0 —	7 19 48	
ST. THOMAS'S ISLAND :			
Cabrita Isle	0 27 0 —	6 45 0	
Anna de Chaves; Road....	0 25 30 —	6 46 0	
Rolas' Isle (<i>On the Line</i>) ..	0 0 0 —	6 36 30	
ANNOBON; East Point	1 25 0 S.	5 42 48	H.M.S. <i>North Star</i> . Captain Purchas.

NOTES.

1. CAPE SPARTEL.—In the *Connaissance des Temps*, this Cape is stated to be in latitude $35^{\circ} 48' 40''$, and longitude $5^{\circ} 53' 1''$. In the *Requisite Tables* it is stated to be in latitude $35^{\circ} 46' 0''$, longitude $5^{\circ} 57' 12''$. The remarks of the late Mr. William Chapman, master of H.M.S. *Illustrious*, appear to confirm the longitude of Tofiño, with whom he differs only 40 seconds in latitude, which he represents as so much more to the southward. The observations of Captain Smyth give the latitude $35^{\circ} 47' 15''$, and the longitude $5^{\circ} 55' 45''$, by chronometer and lunars. Those of Captain Livingston, in 1818, confirm the latitude as in the Table.

2. EMPIRE OF MAROCCO.—The points determined by Captain Washington we owe to an excellent paper, entitled "*Geographical Notice of the Empire of Marocco*;" by Lieut. Washington, R.N.," given in the first volume of the "*Journal of the Royal Geographical Society*," 1831; a communication replete with interesting and useful information, and quite a model for future travellers.

3. CITY OF MAROCCO.—The scientific traveller, Don *Iuan Badia*, commonly called *Ali Bey*, from his observations in 1803, 4, gave the centre of Marocco as in $31^{\circ} 37'$ and $7^{\circ} 35' 30''$. On reference to the *Astronomic Journal* of Captain Washington, there appear upward of 100 sights for determining the longitude of the city. Distances between moon and

and sun; moon, and stars east and west of her; and altitudes of the moon when in the prime vertical,—the mean results of which give the longitude of a garden at the S.W. angle of the city: longitude $7^{\circ} 36' W.$: latitude $31^{\circ} 37' 20''$: mean of about 20 mer. alts. of the sun. *Variation*, from numerous observations by Schmalcalder's compass, $20\frac{1}{2}^{\circ} W.$ —*Geog. Journ.* Vol. I., 140, 141.

4. CAPE GEER, &c.—M. le Chevalier Jean Chas. de Borda was charged in 1776, by Louis XVI., with a commission to the Canary Islands and the Coast of Africa, for the express purpose of making observations, and determining the chief points of the Canary Islands, &c. He was furnished with time-keepers, by which he ascertained the positions, as they have appeared in different Charts and Tables. On this expedition, M. de Borda, in the ship *La Boussole*, was accompanied by the *Espiegle*, M. le Chastenet Puysegur, who afterward composed the Pilot for St. Domingo; also by Captain Don Josef Varela, and another intelligent officer of the Spanish marine; all of whom assisted in the operations. The results proved to be numerous and important; and they served for the general rectification of the coast as far to the southward as Cape Verde.

But, in the years 1817, 18, Captain (now Baron) Roussin was employed by the French government in surveying the coast between Cape Boiador in $26^{\circ} 7' N.$, and the Isles de Los, in $9\frac{1}{2}^{\circ}$, and this officer has given, most satisfactorily, many points not before ascertained.

Again, in 1820 and 1821, Captain Wm. Fitzwilliam Owen, in H.M. ship *Leven*, was commissioned by the British Admiralty to examine and settle the coast from Cape Noon southward; and his observations have still farther, and in a much more important degree, tended to perfect the hydrography of Western Africa. To Captain Owen's Work, therefore, we refer most particularly in the Tables; and have only to add that there is a remarkable coincidence, in general, in the results of the two commanders; and that even in comparing either with those of M. de Borda, the differences, practically considered, are of little moment.

A partial survey of the eastern range of the Canary Islands, and the continental coast thence northward to Cape Spartel, was made by Lieutenants Wm. Arlett and H. Kellelt, commanders of the *Ætna* and *Raven*, in 1835; the particulars of which are given in the 'Journal of the Royal Geog. Society,' Vol. VI. 1836, and from these we derive the corrected positions given in the Table, as more fully shown hereafter.

5. CAPE BARBAS.—In the Admiralty translation of M. Roussin's Memoir, (page 17,) the longitude of Cape Barbas is misprinted $17^{\circ} 30'$.—M. de Borda made it $16^{\circ} 39' 45''$; Captain Owen $16^{\circ} 39' 12''$, as in the Table.

6. CAPE CORVOEIRO.—We assume as Cape Corvoeiro a point in $21^{\circ} 46'$ according to M. Roussin, and not $21^{\circ} 13'$, as given by Captain Owen. The longitude in the translation of M. Roussin's Memoir is misprinted as $19^{\circ} 14' 55''$, which is, we presume, the Paris longitude= $16^{\circ} 54' 33''$ from Greenwich.

7. PORTANDIK.—The two palm-trees are the first seen in sailing hither from Cape Boiador. Portandik is supposed to have been situated about a mile to the southward of this spot, but not a vestige of it remained in 1818, when it was visited by Capt. Roussin. See the description in Section III. hereafter.

8. GOREE.—The position formerly given was $14^{\circ} 40' 10'' N.$ and $17^{\circ} 24\frac{1}{2}' W.$ from the observations of M. Fleurieu, 1769, and of MM. de Verdun, Borda, and Pingré. Capt. Boteler, in 1829, made it the same. The Argo frigate, Captain Hallowell, 1802, gave the latitude $14^{\circ} 39'$, and longitude $17^{\circ} 24' 58''$.

9. CAPE ST. MARY.—From Observations in H.M. ship *Esk*, Captain Purchas, in 1826, the position of Cape St. Mary has been given at $13^{\circ} 29' N.$ and $16^{\circ} 45' 12'' W.$: Bird Island at $13^{\circ} 40' N.$ and $16^{\circ} 44' 12'' W.$ These results show that the points lie at least as far to the West as shown by the Survey.

10. SIERRA LEON, &c.—In preparing the former editions of this work we collected a large number of observations, which had been made, from time to time, on the coast of Guinea, &c., between Sierra Leon and Cape Lopez; they included those previously given by the officers of H.M. ships Argo, Amelia, Inconstant, Tartar, and others, and we finally appended to such as were selected for the tabular statement the following remark: "Although we have paid the utmost attention in the comparison of different results, charts, and descriptions, as shown in the tables and notes, we are by no means satisfied with the

conclusions as to many points eastward of Cape Palmas and St. Andrew's Bay. Indeed, all that has yet been done by the King's officers, and others, prove only the necessity of a new series, in order to establish so much as may be correct, and to rectify so much as may not be so." Happily, such rectification has taken place, and many doubts, even on the most important points, have recently vanished.

We give a specimen, on the longitude of Cape Sierra Leon. Many years ago the late Sir Geo. Young gave the longitude of this Cape as $12^{\circ} 33' 47''$: the French tables afterward, as $12^{\circ} 54'$: the Requisite Tables, $13^{\circ} 9' 17''$; H.M. ship *Argo*, 1802, as $13^{\circ} 12'$; the *Inconstant*, 1816, the same; the *Amelia*, in 1812, $13^{\circ} 17' 30''$; the *Leven* (Capt. Owen) in 1826, $13^{\circ} 18' 0''$; the *Eden* (Capt. Owen) in 1827, $13^{\circ} 18' 30''$; Captain Sabine, R. Art., in 1822, $13^{\circ} 19' 0''$; and Captain Purchas, in 1827, $13^{\circ} 19' 12''$. Hence we adopt Capt. Owen's longitude, as given in the table.

By 318 lunar distances, (23 sets,) taken in the West Bastion of Fort Thornton, at Freetown, Captain Sabine, in 1822, made the longitude of that spot $13^{\circ} 15' 11''$ W.; and, in 1827, Capt. Owen, in the *Eden*, made that of the Victualling-office $13^{\circ} 14' 30''$. Latitude of the latter, $8^{\circ} 30' 6''$; of Fort Thornton, by Captain Sabine, $8^{\circ} 29' 28''$.

"*Fort Thornton* stands on the highest ground in its own immediate neighbourhood, excepting a small hill on which a martello tower is built, at a distance rather exceeding a quarter of a mile; the situation of Freetown, however, may be more generally stated to be at the foot, on the northern side, of the range of mountains, which, coming from the interior, finds here its termination in the sea, and gives the name to the cape, harbour, and colony, of Sierra Leon: the general height of the range, so far as it has been yet explored, is from 2000 to 3000 feet. The principal geological feature in the neighbourhood of Sierra Leon, is a red granite, of easy and rapid decomposition."—(Captain Sabine's Notes.)

11. CAPE MOUNT.—This point was formerly given in $11^{\circ} 17' 30''$; next in $11^{\circ} 23' 30''$, and is now established in $11^{\circ} 21\frac{1}{2}'$ W. For description, see our *Sailing Directory for the Ethiopic or Southern Atlantic Ocean*.

12. CAPE PALMAS.—We formerly gave this cape, from several coherent results, in $4^{\circ} 25'$ N., and $7^{\circ} 41'$ W. It now appears in $7^{\circ} 45'$ W.

13. COAST of GUINEA, between CAPE THREE POINTS and CAPE LOPEZ, including the ISLANDS. Although we described this portion of coast in the *New Directory for the Ethiopic or Southern Atlantic Ocean*, we have considered it proper to continue the series of points in the table, having them from the observations of Captain W. F. Owen, in H.M. ship *Eden*, and Captain Purchas, in H.M. ship *Esk*, both in 1827, with a few others by Captain Kelly, &c. This is to be considered as a valuable acquisition; inasmuch as it affords a decisive confirmation of many points hitherto doubtful; but a few discordancies yet require rectification.

14. RIVER QUORRA.—This important river is described in the Directory mentioned in the preceding note. In the beautiful chart of it, by Captain Wm. Allen, published in 1837, the east point of the entrance, formerly given by mistake in $6^{\circ} 4'$ E., is laid down in lat. $4^{\circ} 20'$ N. and longitude $5^{\circ} 55'$ E. The bar, with two to four fathoms over it, extends two leagues southward from the mouth of the river, which demonstrates the strength of the ebb-tide. Within the bar, in an extent of four miles, the depths are six and seven fathoms, but diminishing thence upward. The town of *Eboe* or *Ibu*, on the western bank of the river, is in lat. $5^{\circ} 41'$, long. $6^{\circ} 26\frac{1}{2}'$: *Damogoo* or *Ada-mugu*, on the eastern bank, in lat. $6^{\circ} 30\frac{1}{2}'$, long. $6^{\circ} 48\frac{1}{2}'$: *Attah*, on the east side of the river, lat. $7^{\circ} 6'$, long. $6^{\circ} 58'$: *Mount Purdy*, on the east, below King William's range, lat. $7^{\circ} 24\frac{1}{2}'$, long. $7^{\circ} 3'$: *Mount Franklin*, on the same side, lat. $7^{\circ} 37'$, long. $7^{\circ} 4'$; confluence of the *Quorra* and *Tchadda*, lat. $7^{\circ} 47'$, long. $7^{\circ} 6'$: *Kakanda*, on the west, lat. $8^{\circ} 22'$, long. $6^{\circ} 54'$: *Egga*, on the same shore, lat. $8^{\circ} 43'$, long. $6^{\circ} 41'$: *Rabba*, on the east, the termination of the survey, lat. $9^{\circ} 14'$, long. $5^{\circ} 27'$.

VARIATIONS OF THE COMPASS.—At Ceuta, in 1811, the variation was found to be $22\frac{1}{2}^{\circ}$ W., and continues nearly the same. At Cape Spartel 22° . Between Cape Spartel and Saffi Bay, it is, at present, from 22° to 21° W.: at Morocco, in 1804, it was found to be $20^{\circ} 38' 40''$ W.: between Saffi Bay and the Canary Islands it is 21° . In 1835, at Mogodor it was $19\frac{1}{2}^{\circ}$, and at Cape Noon 19° . Near Cintra Bay, in $23^{\circ} 5'$, it was $19\frac{1}{2}^{\circ}$ in 1817: near Cape Blanco, $18^{\circ} 9'$: Bar of the Senegal and Goree, $17\frac{1}{2}^{\circ}$: Cape Roxo, $17^{\circ} 20'$. Bissao, and Mouth of the Rio Grande, $17^{\circ} 30'$: Isles de Los, in 1826, 18° : Sierra Leon, in 1827, $18^{\circ} 45'$: Cape Chilling, 1826, 20° : Bashaw or Turtle Isles,

18°: off Cape Palmas, in 1820, 18° 50': off Cape Three Points, and thence to Benin Bar, 19° W.: mouth of the Quorra, 1833, 20° W.

7. THE AZORES OR WESTERN ISLANDS.

(Originally ILHAS DOS AÇORES, or ISLES OF HAWKS.)

	LATIT. N.	LONG. W.	AUTHORITIES.
	° ' "	' "	
FORMIGAS OF ANTS, Middle of the greatest....	37 16 50	24 54 3	
SANTA MARIA, or ST. MARY, Pt. do Castello, or S.E. Point	36 56 47	25 5 45	Mons. C. P. Claret Fleurién, 1769; and Don Vincente Tofino, 1788.
Town of St. Mary	36 53 0	25 12 18	
Pt. de Maldemarenda, or S.W. Point ....[1]..	36 57 31	25 14 3	
SAN MIGUEL, or ST. MICHAEL's, Ferraria, or West Point ..	37 54 15	25 55 15	REMARKS. The longitude of St. Michael's is given from Tofino's separate result, which is more easterly than that of Fleurién. Our friend Captain Livingston, from four sets of lunar distances, taken on board the ship Asia, 4th and 5th October, 1818, made it a little to the eastward of the position given in the Table. But Captain Fitzwilliam Owen has stated, in his Memoir, that the longitudes, as annexed, were ex- amined and <i>proved to be correct</i> , by H.M. ship Leven, in 1820.
City of Ponta Delgada ..	37 45 10	25 41 15	
Pt. de la Marquesa, or East Point.....[2]..	37 48 10	25 10 5	
TERCEIRA, Mt. de Brasil, near Angra	38 38 33	27 12 33	
ST. GEORGE, Pta. del Topo, or S.E. Point	38 29 22	27 50 27	
GRACIOSA, Pta. del Carapacho, or S.E. Point	39 0 0	27 57 45	
PICO, The Summit of the Peak ..	38 26 15	28 27 58	
FAYAL—The S.E. Point, or Morro de N.S. de la Guia	38 30 12	28 41 37	
FLORES—The North Point, or Ponta del Gada....[3]..	39 33 29	31 8 15	
CORVO—The Southern Point, or Pta. del Pesqueiro-alto ..	39 41 13	31 2 45	

NOTES.

1. AZORES.—The voyage of M. Fleurién, in the Isis frigate, made in 1768-9, and published in 1773, has furnished several observations of the points of the Azores, as shown by the marine-clocks of M. Ferdinand Berthoud, and verified, in great measure, by more numerous observations of Don Vincente Tofino, made in 1788. The difference in the results of these two observers is, generally, inconsiderable; so small, indeed, that it may rather be considered as an agreement.

M. Fleurién ascertained the position of the Mount of Brasil, near Angra, in Terceira, to be 38° 38' 37" N. and 27° 12' 27" W. Tofino's result was 38° 38' 10", and 27° 12' 40"; a remarkable coincidence, considering the distance of time at which the observations were made. The longitude of this spot was, therefore, assumed by the Spanish commander, as the meridian referred to from the points subsequently determined. The summit of the mount, as lately given by Captain Fitzroy, R.N. is in 38° 38' 35", and 27° 13'.

2. ST. MICHAEL'S, &c.—In our former statements we noticed the erroneous positions of St. Michael's, Terceira, &c., which had, from time to time, appeared in the *Requisite Tables* and *Connaissance des Temps*; but, as the doubts have vanished, it would be no longer useful to repeat those remarks. Captain Fitzroy gives St.-Bras Castle, near Ponta Delgada, in 37° 43' 58", and 25° 40' 15".

3. FLORES and CORVO.—The longitude of these islands is given according to the results of

of Tofino only; having inferred, on comparison, that they are the most exact. Vide the Chart of the Azores, Canary Islands, and opposite coasts, with the harbours, &c., constructed by the editor, and published by the proprietor, of this work. The late Sir Home Popham, from several observations, lunar and chronometric, inferred the longitude of the North point of Flores as $31^{\circ} 11'$, or $2' 45''$ more to the westward than the position assigned by Tofino.

VARIATION OF THE COMPASS.—At St. Michael's, in 1826, the variation was $24^{\circ} 15'$ W. At Flores, 19° W. Captain Livingston, by mean of many observations, near Ponta Delgada, found it about 25° W. in 1818. This gentleman properly observes, that differences may be ascribed to the volcanic commotions and ferruginous nature of the country. See Note on the variation at Tenerife, hereafter.

LIGHTHOUSES.—The lighthouses of the island of St. Michael, *such as they are*, will be found described in a note on that island hereafter.

8. THE MADEIRA AND CANARY ISLANDS.

	LATIT. N.			LONG. W.			AUTHORITIES.	
	°	'	"	°	'	"		
MADEIRA.								
Town of Funchal ....[1.]..	32	38	0	16	54	26	Capt. Matt. Flinders, H.M.S. Investigator, 1801; General Sir Thos. Brisbane, 1821.	
Punta del Pargo, the West Pt.	32	49	0	17	15	54		
Brazen Head; S.E. extremity	32	37	18	16	51	42	Captain W. Fitzwilliam Owen, 1820, 1827.	
Pta. de S. Lorenzo, the E. Pt.	32	43	54	16	38	12		
PORTO SANTO. The village on the South side.....[2.]..	33	3	0	16	18	30		
THE SALVAGES.								
Middle of the Great Salvage .....[3.]..	30	8	30	15	54	36	The observations, by chronometers, &c., of M. le Chev. de Borda, under the order of the French Government, in 1776. See Note 4, on the Coast of Africa, page 32.	
LANZAROTA, OR LANCEROTE.								
Allegranza I. off the North End	29	25	30	13	30	30		
Port de Naos	28	58	30	13	32	30		
FORTAVENTURA.								
I. of Lobos, off the N.E. Pt.	28	45	0	13	48	30	See Note 4, on the Coast of Africa, page 32.	
Pt. Handia, the S.W. Pt. ...	28	4	0	14	31	0		
CANARIA, OR GRAND CANARY.								
The Isleta, or N.E. Point ..	28	13	0	15	24	30	But the general mean of the longitude of the Mole of Santa Cruz, from the observations of Captains Perouse, Bligh, Vancouver, and Krusenstern, of M. Quenot, and the Baron Alexander de Humboldt, is 16° 15' 18".	
Pt. Arguinequi, the South Pt.	27	45	0	15	38	0		
Pt. Aldea, the West Point ..	28	1	20	15	50	30		
TENERIFE, OR TENERIFFE.								
Mole of Santa Cruz ..[4.]..	28	28	30	16	15	30		
Le Pic, or the Peak	28	17	0	16	39	30		
L'Orotava (N.W. side)	28	25	0	16	34	30		
COMERA.								
The Port	28	5	40	17	7	30		
PALMA.								
Sta. Cruz, on the E. side [5.]	28	43	0	17	45	30		
Tasacorta, on the W. side ..	28	38	0	17	57	30		
FERRO.								
Town of Valverde....[6.]..	27	47	20	17	56	30		
La Dabessa, or Western Point	27	44	0	18	9	30		

NOTES.

1. FUNCHAL.—The latitude of Funchal is well ascertained. The longitude was estimated by M. Bory, in 1772, at $16^{\circ} 56'$, as it has since stood in the French tables. Capt. Horsburgh, in his first edition, states that he found it, by good chronometers, $17^{\circ} 6'$; and Mr. Wales's observations, by time-keeper, in 1772, gave it $17^{\circ} 6' 22''$. It is at length unnecessary to repeat the varying results of other observers; the differences having been decided by our late respected countryman, Captain Flinders; from whose observations, in H.M. ship *Investigator*, 1801, the latitude of the Road appeared to be $32^{\circ} 37' 44''$, and the greatest longitude, by any of six time-keepers, $16^{\circ} 54' 26''$. "This was given by Earnshaw's watch, No. 465, which had kept an uniform rate during fifteen months previously to its being brought on board. We made use of this watch to reduce some lunar observations taken a few days before arriving at, and others after sailing from, the place of anchorage; and the result was as follows:—

"Ten sets of distances, east and west of the moon, taken by Mr. Crosley, in Funchal Bay, and afterward, with a Troughton's sextant, $16^{\circ} 59' 21''$.

"Eight sets, east and west, taken by me with a Troughton's circle and two sextants, before and afterward, $16^{\circ} 51' 28''$."

Hence, west longitude of Funchal, by lunar observations—Mean $16^{\circ} 55' 24''$. The Variation, in 1811, was 21° West.

After the above was written, we were informed by Mr. William Smith, the gallant Master of H.M. ship *Asia*, (since killed in the battle of *Navarino*), that, by observations taken in H.M. ship *Ganymede*, 9th August, 1818, Funchal Road appeared to be in $32^{\circ} 37' 33''$ N. Longitude, by chronometer, $16^{\circ} 55' 30''$; by lunars, $16^{\circ} 57' 15''$. Mr. J. Town, Master of the *Salisbury*, in Feb. 1816, made the longitude, by chronometer, $16^{\circ} 55' 42''$.

His excellency Sir Thomas Brisbane, on his voyage to New South Wales, (1821), obtained his time at the house of Mr. J. W. Gordon, at Funchal, by four excellent chronometers, from which the mean longitude was concluded as $16^{\circ} 54' 36''$. At the same time the latitude of the tower, on Mr. Gordon's house, was found to be $32^{\circ} 38' 19''.7$, and that of the Loo Rock $32^{\circ} 37' 53''.8$. The longitude given by Sir Thomas Brisbane was confirmed by ten Admiralty chronometers, under the care of Dr. Tiarks, in 1823, which gave for the longitude of the British Consul's garden $16^{\circ} 54' 45''$. (In time 1 h. 7 m. 39 s.)

Captain Fitzwilliam Owen, from observations in H.M. ship *Leven*, in 1820, gives the Landing Place, near the Loo Castle, in $32^{\circ} 37' 42''$ N. and $16^{\circ} 55' 30''$ W.

DESERTAS.—Captain Flinders states the southern end of the Bujio to be in latitude $32^{\circ} 24' 20''$, which differs less than a mile from its position as previously given on the charts; and he discovered a small ledge of rocks projecting from under the cliffs at the S.W. part of this island. Captain Owen gives the north end of the Northern Deserta in $32^{\circ} 36' 30''$ N. and $16^{\circ} 33'$ W. The south end of the Southern Isle (*Bujio*) he gives in $32^{\circ} 28' 30''$ N., and $16^{\circ} 31' 18''$ W. It may probably be rather more eastward, but certainly not more west.

2. PORTO SANTO.—A plan of this island, from a Survey by Lieut.-Colonel Roberts and Captain Thomas Wolley, of H.M. ship *Arethusa*, 1802, states, in general terms, the latitude of the town to be $33^{\circ} 2'$, and its longitude $16^{\circ} 35'$, which is only 20 minutes East of the meridian of Funchal. But, upon a comparison of this statement with the different tables and charts, we are apprehensive that the difference should be at least 37 minutes, and have so assumed it in the Table. See the Chart of the Azores and Canary Islands, before mentioned. The Req. Tab. and Conn. des Tems, give the latitude of the middle of the Isle $35^{\circ} 5'$, and the longitude $16^{\circ} 14' 51''$, and $16^{\circ} 17' 30''$. Captain Owen gives the governor's house in $33^{\circ} 2' 54''$ N. and $16^{\circ} 18' 48''$ W.

3. THE SALVAGES.—The longitude of the Great Salvage, as lately furnished by five British East-India Journals, differs from $15^{\circ} 34'$ to $16^{\circ} 1'$. The mean result of these is $15^{\circ} 48'$ W. Yet we have not deemed this evidence sufficient to cause a deviation from the position assigned in the table.

M. la Perouse has observed, "We were employed on the 18th of August, 1785, in taking observations off the Salvage, and I think its longitude may be fixed in $18^{\circ} 13'$, ($15^{\circ} 53'$ from Greenwich), and its latitude $30^{\circ} 8' 15''$."

Capt.

Capt. Wm. Mudge, R.N., who, with Captain Vidal, surveyed the Great Salvage in 1820, places its south side in $30^{\circ} 7' 39''$ N. and $15^{\circ} 56' 18''$ W.; and he says of it, "This island is obviously of volcanic origin, and consists principally of a dark-coloured black rock, the detached parts of which, as well as the whole, exhibit strong marks of fixed magnetic polarity. Even the dust of the roads, and of the floors of the cottages, has the same character as the rock itself, and may be gathered up, like steel-filings, by means of a bar magnet.

"The compass was singularly deranged at the three stations taken on the survey, and the extreme difference in its variations amounted to about seventy-two degrees, at a less distance than one mile. At the first station, one morning, Mr. Durnford, one of the party, laid down his watch, and on returning to the same place again it was found that the watch had gained two hours in the interval, an acceleration due to the magnetic action of the rock upon the balance."

4. TENERIFE.—The position of Sta. Cruz, given in the Table, has been sufficiently confirmed. M. le Perouse says, "Several observations were made at Santa Cruz, in Tenerife, which we think may be fixed at $18^{\circ} 36' 30''$ ($16^{\circ} 16' 6''$ from Greenwich,) and $28^{\circ} 27' 30''$ N. In 1817, the Baron Roussin, of the French navy, placed the Mole Head of Santa Cruz in $28^{\circ} 27' 58''$ N. and $16^{\circ} 16' 0''$ W., and from this meridian he deduced, by chronometers, the longitudes of all the coast between Cape Boiador and the Isles de Los, which have already been described.

Captain Fitzwilliam Owen, from his observations in the *Leven*, 1820, gives the Mole Head in $28^{\circ} 27' 54''$ N. and $16^{\circ} 15' 0''$ W. The Peak he gives in $28^{\circ} 16' 24''$ N., and $16^{\circ} 39' 0''$ W., thus confirming the longitude of M. Borda, given in the Table.

5. PALMA.—The observations of Captain L. Wilson, by chronometer, place the north point of Palma between 6 and 7 minutes to the East, and the south point 3 minutes to the West, of M. de Borda's positions. This is a farther confirmation of the accuracy of that excellent observer. On the 21st of February, 1818, Captain J. W. Monteath made the longitude of the Point of Santa Cruz, on this island, by chronometer, to be $17^{\circ} 45' 30''$ W. and the latitude of Point Gaviota, on the North side, $28^{\circ} 51' 30''$ N., and longitude $17^{\circ} 48' 30''$ W.

6. FERRO.—Captain Livingston has proved, by chronometers, (from the Loo Rock, Madeira,) that Ferro lies as far to the west as represented, and not, as formerly suspected, more to the east. He made La Debessa $18^{\circ} 13' 0''$ W.

VARIATIONS OF THE COMPASS.—Between Porto Santo and Madeira, the mean Variation is about 22 degrees. In the Road of Santa Cruz, Tenerife, it is rather less, if we may conclude that it has been correctly ascertained: but M. de Humboldt has noticed that the variation differs several degrees, according to the place where the observation is made, at the Mole, or at several points to the north, along the shore: and, he adds, we must not be surprised at these deviations in a place surrounded by volcanic rocks. "I remarked, with Mr. Gay Lussac, that, on the declivity of Vesuvius, and the inside of its crater, the intensity of the magnetic forces is modified by the proximity of the lavas."—*Personal Narr.* Vol. I. 117. Captain Owen gives the variation at Porto Santo as $23\frac{1}{2}^{\circ}$ W.

9. THE CAPE VERDE ISLANDS.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
SAL or SALT ISLAND: [1.]							
The North Point	16	51	0	22	58	30	The Survey of the Cape Verde Islands, by Lieutenants (since Captains) Vidal and Mudge, R.N.; taken by order of the Lords Commissioners of the Admiralty, in the years 1819, 1820, and 1821.
The South Point	16	34	0	23	0	0	
BONAVISTA:							
The N.W. Point	16	13	20	22	59	40	
The N.E. Point	16	11	0	22	46	30	
The New Town	16	7	0	22	59	30	
The South Point	15	57	0	22	52	40	
Leton Rock	15	48	0	23	13	0	

THE CAPE VERDE ISLANDS CONTINUED.

	LATIT. N.	LONG. W.	AUTHORITIES.
	° ' "	° ' "	
MAYO or ISLE of MAY : [2.]			
The North Point	15 19 30	23 16 0	REMARKS.
English Road	15 7 30	23 17 0	
South Point	15 6 40	23 14 0	
ISLAND of St. IAGO :			In the former editions of this work, we gave a detail of the observations, made at different times, for determining the situation of the Cape Verde Islands; particularly those made by Messrs. Fleuriu, Borda, Verdun, &c., by Mr. R. Keilor, Captains P. Heywood, Mortlock, &c. The results generally, in regard to longitude, placed the islands a few minutes more to the eastward. We then gave Porto Praya in 23° 30' 34", now given in 23° 34' 0"; the Road of Brava in 24° 45' 55", now 24° 47' 30"; but to the western side of St. Antonio we assigned 25° 25', since confirmed, not only by the Admiralty Surveyors, but by Captain Monteath and other observers. Captain Owen, from observations in the Leven, 1820 to 1822, places St. Antonio rather more to the east. Its western point he gives in 25° 23' W. (not 25° 25' 45".) The north point of Sal he gives in 22° 55' 30", and not 22° 58' 30" W.: the north point of S. Iago in 23° 46' 54", not 23° 49' 30",—Port Praya (<i>Quail I.</i>) in 23° 31' 12" W., not 23° 34'. Captain Monteath made the town of Port Praya in 23° 32' W.
Bighude or North Point ..	15 19 30	23 49 30	
East Point	15 0 30	23 29 0	
Porto Praya	14 53 40	23 34 0	
S.W. Point	14 58 30	23 47 0	
ISLAND of FOGO :			
North Point	15 1 15	24 25 0	
Town of N.S. da Luz	14 53 0	24 34 0	
BRAVA :			
Road on the West side ..	14 48 0	24 47 30	
ST. NICOLAS :			
East Point	16 34 30	24 3 0	
North Point	16 42 0	24 24 20	
West Point	16 38 0	24 30 0	
South Point	16 28 30	24 22 0	
RAZA ; East Point	16 38 0	24 38 30	
ST. LUCIA :			
East Point	16 46 0	24 45 0	
North Point	16 49 0	24 50 30	
ST. VINCENT :			
Porto Grande	16 54 0	25 4 0	
ST. ANTONIO : [3.]			
North Point	17 12 0	25 9 20	
West Point	17 4 0	25 25 45	
South Point	16 55 0	25 22 0	
East Point	17 5 30	25 2 40	

NOTES.

1. SAL.—A particular description of Sal and all the other islands will be found in our third section, hereafter.

2. MAYO.—In the course of the year 1819, while surveying the island Mayo, Lieuts. Vidal and Mudge found the hills upon which they were carrying on their operations so strongly magnetic that the needle belonging to the theodolite became wholly useless; the dip increasing so much that the needle could not traverse, in consequence of one end of it being drawn down to the face of the instrument, &c.

3. ST. ANTONIO.—Commodore (now Admiral) Von Krusenstern, in the relation of his voyage around the world, says, "On the 6th of November, (1803,) at day-break, we perceived the island of St. Antonio, at the distance of from 25 to 28 miles. As the wind was moderate, I held directly to the westward, to keep still more away from the land, as calms are very frequent in the neighbourhood of lofty islands. At noon we had an observation in 17° 55' latitude. The S.W. point of the island bore, at the time, S. 24° E., distant about 45 miles. I now steered W.S.W., and as the wind freshened toward the evening, S.W. by W. The next day, at noon, the S.W. part of the island St. Antonio bore 86°, distant about 54 miles; and I again held S.S.W.

"The mean of a variety of lunar observations, taken this morning, made our longitude, reduced to mid-day, 26° 17' 7". By the watches it was 26° 24' 40". I reckoned the longi-

longitude of the S.W. point of St. Antonio, by Arnold's large time-piece, No. 128, the best of our chronometers, $25^{\circ} 24' 0''$." (*Mr. Hoppner's Translation*, page 53.)

Captain Flinders, in the relation of his voyage, (Vol. I. p. 26,) has said, that he found the variation near the western side of St. Antonio, in the evening of the 14th August, 1801, before making the land, $13^{\circ} 51'$; and in the next evening, $13^{\circ} 3'$, when four leagues to the westward. He had not an opportunity of making observations to determine the situation of the island, but, according to his estimation, it would appear to be even more to the eastward than the situation now assigned; as he supposed the high land near the S.W. point to be in $25^{\circ} 12' W$.

For further information, see the Chart of the Cape Verde Islands, *Second Edition*, published by the proprietor of this work, and see, also, the description of St. Antonio, hereafter.

VARIATIONS.—In 1826 the Variation of the Compass near St. Antonio was found to be near 16 degrees: at Port Praya, St. Iago, 15° West. The mean variation allowed by Captains Vidal and Mudge is 14° . *Lighthouses*, none.

10. GREENLAND, LABRADOR, & NEWFOUNDLAND.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
GREENLAND.							
Cape Danell..... [1.]..	65	37	0	36	10	0	The CHART of GREENLAND, published by authority at Copenhagen, in 1832, to illustrate the voyage of Captain Graah, &c. and which also exhibits a portion of Iceland, Scoresby's Land to the N.E., and the coast to the N.W., from various authorities, up to the parallel of 73° N.
Dannebrog's Öe or Isle	65	18	0	38	30	0	
Cape Löwenorn (<i>Var.</i> 54° W.)	64	30	0	39	30	0	
Colberger Heide	64	8	0	40	7	0	
Cape Mosting	63	40	0	40	15	0	
Cape Juel	63	15	0	40	50	0	
Kinarbik (<i>Var.</i> 53° W.).....	62	47	0	41	42	0	
Cape Bille	62	1	0	41	57	0	
Cape Tordenskiold	61	24	0	42	15	0	
Cape Discord	60	53	0	42	26	0	
Cape Vallöe (<i>Var.</i> 50° W.) ..	60	38	0	42	40	0	
Statenhuk, otherwise C. Farewell	59	49	12	43	53	40	
Cape Christian	59	49	30	44	5	0	
Friedrichsthal	60	0	0	44	36	0	
Nennortalik (<i>Var.</i> 51° W.)....	60	7	45	45	20	0	
Julianeshaab	60	44	0	46	3	0	
Cape Thorvaldsen	60	44	0	47	56	0	
Cape Desolation	60	48	0	48	10	0	
Cape Absalon	61	3	0	48	23	0	
Frederikshaab (<i>Var.</i> 56½° W.)	62	2	0	50	2	0	
Lichtenfels	63	5	0	51	31	0	
Fishermoes	63	8	0	51	21	0	
LABRADOR.							
Button's Isles; Middle.. [2.]..	60	35	0	65	20	0	Connaissance des Tems, &c. Captain T. Manby, R.N., 1808. Inferred from Port Manvers.
Port Manvers; Entrance [3.]..	57	0	0	61	55	0	
Nain, a Moravian settlement ..	56	24	0	61	48	0	
Leveret Islet, at the Entrance of Netsbucktoke, or Sandwich Bay	53	50	40	56	32	0	The Admiralty Surveys, by Lieut. Michael Lane, &c. to 1790.
Wolf Island; North end [5.]..	53	45	0	55	37	0	
Spotted Island; N.E. end	53	30	30	55	26	30	
Round Hill Island	53	25	20	55	21	0	
Hawke Island; S.E. point....	53	4	20	55	26	0	
Cape St. Michael	52	47	0	55	27	0	

LABRADOR AND NEWFOUNDLAND, CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.	
	°	'	"	°	'	"		
Cape St. Francis .....[6.]..	52	37	0	55	23	30	The Admiralty Surveys, by Lieut. Michael Lane, &c. to 1790.	
Point Spear .....[7.]..	52	32	0	55	20	30		
Cape St. Louis	52	25	30	55	20	0		
Cape Charles' Island	52	16	40	55	17	0	The Surveys of Captain Jas. Cook, 1767, adjusted by Lieut. Fred. Bullock, R.N., 1823, 1824.	
Belle Isle; N.E. point	52	0	33	55	11	20		
— S.W. point	51	52	26	55	19	31		
York Point	51	55	0	55	42	30		
Barge Point	51	47	30	56	2	30		
Forteau Point	51	26	30	56	54	30	* * * Captain Bayfield has since given Cape St. Louis in 52° 21' 24" N., and 55° 41' 30" W.	
Green Isle, without Bradore Harbour	51	24	30	57	11	30		
NEWFOUNDLAND.								
Cape Norman	51	37	0	55	48	0	The Admiralty Surveys, by Lieutenant (since Captain) Fred. Bullock, R.N., and his assistants, Messrs. Thos. Smith, &c. 1823, 1824, 1825, and 1826.	
Cape Bauld	51	38	10	55	20	30		
Griguet Bay; East point.....	51	32	30	55	21	30		
White Cape, near St. Lunaire Bay .....[8.]..	51	30	25	55	21	33		
Needles Rocks, near Braha ..	51	26	5	55	22	45		
Braha Shoal (6 ft.)	51	25	40	55	20	0		
Cape St. Anthony.....[9.]..	51	21	0	55	25	15		
Cremalliere Cove; Entr. E. pt.	51	18	30	55	30	30		
Goose Cape; S.E. pt.....	51	17	20	55	31	0		
Howe Harbour; Entr.W.pt.[10]	51	20	0	55	51	0		
Fishot Isles; Northern Isle ..	51	12	30	55	34	30		
Croque Harbour; Entrance [11.]	51	2	30	55	41	30		
Groais Isle; N.E. point.....	50	58	30	55	27	0		
Southern Belle Isle; N.E. point	50	48	0	55	22	30		
Rouge Isle; North point [12.]	50	54	0	55	42	0		
Canada Bay; Entrance	50	42	30	56	2	0	REMARKS. By these excellent Surveys a very important desideratum has been obtained; for, before they were executed, the coasts which they display were comparatively unexplored, although frequented, more or less, by the fishers. In the notes annexed we have particularized some of the Harbours, and others are described in the <i>New Sailing Directory for Newfoundland, &c.</i> , 1837. <i>Cape Norman</i> is placed by Captain Bayfield in 51° 38' 5" N. and 55° 56' 21" W. (8' 21" more to the west); but we are not acquainted with his data, and have considered it as most prudent to retain the longitudes given in the Table.	
Hooping Harbour; Entrance ..	50	36	0	56	7	40		
Fourchet Harbour; Entrance ..	50	31	0	56	11	0		
Orange Bay; Entrance	50	22	0	56	21	0		
Little Harbour-Deep Head....	50	14	0	56	27	0		
Cat Head; Extremity	50	7	0	56	34	30		
Coney Arm Head	49	57	30	56	40	0		
Partridge Point	50	9	20	56	3	30		
Fleur de Lys Harbour; East point .....[13.]..	50	6	40	56	2	10		
St. BARBE, or HORSE ISLES; S.E. point	50	11	0	55	36	40		
Pacquet Harbour; Entr.[14.]..	49	58	30	55	45	0		
La Scie Harbour; Entr. [15.]..	49	58	0	55	31	0		
PROMONTORY OF ST. JOHN:								
North Bill	49	59	30	55	25	0		
Middle Cape	49	57	30	55	23	0		
South Bill.....	49	56	5	55	23	30		
St. John's Gull Isle	49	59	30	55	16	0		
Bishop's Rock	49	55	30	55	21	30		
Nippers Isles; S.E. point [16.]	49	47	0	55	46	0		
Cutwell Harbour; [17.] East pt.	49	37	0	55	34	0		
Triton Harbour; Entrance [18.]	49	33	0	55	31	0		
Fortune Harbour; [19.] N.W. pt.	49	32	0	55	10	0		
Toulinguet Harbour; N. Entr.	49	36	0	54	41	30		
Change Isles; N.E. Islet [20.]	49	41	35	54	18	0		
Fogo Harbour; [21.] Eastern Ent.	49	44	20	54	11	36		

NEWFOUNDLAND, CONTINUED.

	LATIT. N.	LONG. W.	AUTHORITIES.
Cape Fogo; S.E. extremity ..	49° 39' 30"	53° 55' 0"	The Admiralty Surveys, by Lieutenant Fred. Bullock, R.N. and his assistants, Messrs. Thos. Smith, &c. 1823, 4, 5.
Ireland Rock (Always breaks) ..	49° 51' 45"	53° 58' 0"	
Inspector Rock (Sometimes breaks)	49° 47' 0"	53° 50' 40"	
Snap Rock, of 10 feet	49° 54' 0"	53° 38' 20"	
Funk Island; [22.] Escape or E. point	49° 44' 21"	53° 7' 20"	The Admiralty Surveyors, Messrs. George Holbrook and William Bullock, 1819 to 1826.
Green Island in Rocky Bay ..	49° 29' 0"	54° 7' 0"	
Ragged Point	49° 30' 0"	53° 54' 0"	
Deadman's Point	49° 25' 18"	53° 37' 30"	
Outer Cat Island	49° 23' 25"	53° 32' 20"	
Freels' Gull Island [23.]	49° 19' 6"	53° 20' 58"	
Charge Rock (6 feet)	49° 18' 0"	53° 17' 10"	
Stinking Islands	49° 13' 40"	53° 16' 20"	
Fool's Island, off the N.W. Arm ..	49° 9' 15"	53° 30' 30"	
Shoe Cove Point	49° 4' 40"	53° 31' 30"	
Offer Gooseberry Island	48° 58' 20"	53° 27' 0"	REMARKS. In our former editions we deduced the longitudes of the S.E. and South coasts, from the Observations and Surveys of Capt. Jas. Cook, Lieut. M. Lane, Messrs. Cassini, Verdun, Borda, Pingré, and Owen; and these were generally, from 8 to 3 minutes eastward of those now given in the Table: but the longitude of the Burgeo Isles [<i>Eclipse I.</i>] remains as given by Captain Cook; and that of St. Pierre may, also, be considered as the same. A Survey of Port St. Pierre, by Lieut. Dupetit Thouars, gives the government house, N.E. of the town, in 46° 46' 30" N., and 56° 9' 45" W. The French astronomers, Messrs. Verdun, Borda, and Pingré, in the voyage of <i>La Flore</i> , 1771, gave the town of St. Pierre in 46° 46' 30" N., and 56° 10' W., and thus confirmed the previous determination of the Burgeo Islands, by Captain Cook, from a solar eclipse, in August, 1766. (<i>Phil. Trans.</i> 1767.) It is, however, to be noticed that Captain Bayfield places Cape Ray in 47° 36' 56", and long. 59° 20' 10", or 3 minutes west of the longitude in the Table; but see Note 6, on Quebec, in the next section.
Malone's Rock	48° 53' 30"	53° 24' 40"	
Great Black Island; Centre of ..	48° 50' 8"	53° 32' 15"	
Little Denier Island	48° 40' 50"	53° 30' 50"	
Western Head	48° 37' 15"	53° 22' 0"	
Southern Head	48° 37' 15"	53° 16' 0"	
Young Harry Reef	48° 48' 5"	52° 58' 15"	
Bonavista' Gull Island	48° 42' 40"	52° 59' 20"	
North Head, Catalina	48° 32' 28"	52° 56' 6"	
South Head, Catalina	48° 27' 38"	53° 0' 52"	
Horse Chops	48° 21' 30"	53° 8' 30"	
Entrance of Trinity Harbour ..	48° 21' 30"	53° 16' 50"	
Bonaventure Head	48° 16' 30"	53° 18' 10"	
Bacalieu, North Point of	48° 9' 1"	52° 44' 46"	
Cape St. Francis	47° 48' 4"	52° 43' 41"	
St. JOHN'S Church ..[24.] ..	47° 34' 35"	52° 38' 37"	
Cape Spear	47° 30' 53"	52° 33' 27"	
Bull Head	47° 18' 1"	52° 41' 19"	
Cape Broyle, North Point of ..	47° 3' 52"	52° 47' 27"	
Cape Ballard	46° 46' 46"	52° 53' 23"	
Cape RACE	46° 39' 44"	52° 59' 9"	
Cape Pine	46° 37' 14"	53° 30' 2"	
St. Mary's Cape	46° 49' 25"	54° 8' 45"	
Placentia Harbour	47° 15' 11"	53° 55' 3"	
Little Southern Harbour	47° 43' 32"	53° 54' 38"	
Extremity of Placentia Bay ..	47° 49' 46"	53° 57' 14"	
Bordeaux Harbour	47° 45' 28"	52° 58' 30"	
Cape Chapeaurouge	46° 54' 19"	55° 20' 31"	
St. Pierre; Lighthouse	46° 46' 52"	56° 8' 44"	
Cape Miquelon	47° 8' 11"	56° 19' 30"	
Connaigre Shoal	47° 23' 57"	55° 57' 19"	
Pass Island	47° 29' 2"	56° 11' 13"	
Cape La Hune	47° 31' 55"	56° 50' 23"	
Outer Penguin Island	47° 22' 9"	56° 58' 7"	
Eclipse Island	47° 36' 6"	57° 36' 15"	
CAPE RAY	47° 37' 3"	59° 17' 10"	
Cape St. George	48° 28' 54"	59° 14' 34"	
South Head	49° 6' 12"	58° 20' 40"	
Cow Head	49° 55' 12"	57° 51' 16"	
Point Ferolle	51° 1' 29"	57° 5' 47"	
Anchor Point	51° 14' 30"	56° 45' 30"	

NOTES.

1. **CAPE FAREWELL.**—In the maps and charts, in general, the name of Cape Farewell is attached to the southern point of the continent of Greenland. In the Dutch charts, which have been republished in London, the same name is applied to an island, at the assumed distance of 45 leagues W.N.W. from that point. Hence, one point has frequently been mistaken for, or blended with, another: and this affords, therefore, one reason for the discordant accounts of longitude, &c. Such mistakes are not likely again to occur, as will be seen by the following statement.

In the first volume of the ‘Journal of the Royal Geographical Society,’ is given an account of *Discoveries on the Eastern coast of Greenland*, by Captain Graah, of the Danish Royal Navy, in 1829, who proceeded along the coast from Staten Hook to the parallel of $65\frac{1}{2}^{\circ}$, and who has disproved the existence of any antient European colony upon it. In a single boat, amid difficulties almost insuperable, with only two Greenland men and four women, M. Graah reached an island, in latitude $65^{\circ} 18'$, longitude, *computed*, $38^{\circ} 27'$, and proceeded onward until stopped by an insurmountable barrier of ice, and forced to return to the S.W.

All the coast appeared to be colder, more barren and miserable, than the western coast. “It may be said to consist of one uninterrupted glacier, exhibiting only a few patches of vegetation, generally on the banks of the rivers, and elsewhere, often advancing into the sea and forming promontories of ice, which are passed with so much the more danger, that they frequently fall in avalanches.”

During the whole summer of 1829, there was not one day which could be called warm; and before the 14th of June the thermometer had never risen above 53° . At *Ekolumius*, in lat. $63^{\circ} 30'$, the vegetation appeared to be superior to that of any other part of the coast, even of *Julianeshaab*, on the S.W., reputed to be the most favoured part of that coast. But the vegetation appears to consist only in a fine grass, which withers quickly when exposed to the warmth of the sun, and in some anti-scorbutic plants, as sorrel and scurvy-grass, with one or two kinds of flowers, and low bushes of willow and birch, not exceeding two feet in growth.

The food of the natives is principally the dried flesh of the seal, with a little game and fish. Captain Graah makes mention of bears, hares, birds, and salmon; but he says that, “even at the latitude of $63^{\circ} 36'$, rein-deer and hares are known only by name.” The people, in their moral character, he describes as very estimable; “and the reported good nature of the husbands, the submission of their wives, the obedience of the children, and the mutual affection and confidence of the whole community, make it difficult to remember that they are pagans. It was the good faith, the hospitality, the kind and generous dispositions, of these children of nature, that enabled M. Graah to overcome the difficulties by which he was surrounded.”

On the 3rd of November, 1831, Captain Graah returned to Copenhagen from a second voyage along the coast of Greenland, but without having passed much to the northward of his former limit. The Geographic Society of Paris subsequently presented their gold medal to the captain, accompanied by their diploma, for his persevering and indefatigable attempts in exploring this coast.

During his last stay, Captain G. determined the longitudes of the two southern Danish settlements, *Julianeshaab* and *Nennortalic*, with great precision, by means of occultations of fixed stars, &c. and we also gain, by his observations, the positions of *Cape Farewell*, never before ascertained, and *Cape Christian*, another promontory of the same island: Cape Farewell, latitude $59^{\circ} 49' 12''$, long. $43^{\circ} 53' 40''$: Cape Christian, lat. $59^{\circ} 49' 30''$, long. $44^{\circ} 5' 0''$.

The eastern coast, latterly explored, is now distinguished by the name of the late excellent king, *Frederick VI.*

It may be agreeable to many of our readers to be informed that, in No. 27 of the ‘Nautical Magazine,’ is included a paper entitled “*Arctic Expeditions from England*,” which displays a summary of the whole, from the time of the Cabots, in the reign of Henry VII. to the year 1834, and is one of those documents which no Englishman can peruse without pride and gratification.

2. **LABRADOR.**—For the formation of icebergs on this coast, which are so often met with to the southward, see our 'MEMOIR,' &c. on the Northern Ocean, page 43.

3. **PORT MANVERS**, formerly called Saltpetre Haven, was visited and explored by the *Thalia* and *Medusa* frigates, which wooded and watered here, in August, 1808. Of the mode in which the longitude was determined we have not yet been informed. The coast, as well as that of Greenland, now appears more to the westward than it was formerly represented.

Of Port Manvers a particular plan is given on our large chart of the Northern Ocean. Without the entrance, on the east, are two groupes of small isles, and near it is a cluster of dangerous rocks. The entrance itself is less than a mile broad, but the land within opens into a fine basin, on the shores of which are wood, water, and winged game, in abundance. At about two leagues, *true south*, from the entrance, is *Mount Thoresby*, 2733 feet in height.

4. **SANDWICH BAY.**—This fine harbour was surveyed by Lieut. Michael Lane, in 1771, but not the different entrances. The defect was, however, remedied by Lieut. Robert Pearce, of H.M. ship *Favourite*, in 1820. A range of mountains, called *Mealy Mountains*, stand on the N.W. side of the harbour, and, being 1482 feet in height, always covered with snow, may be seen from without Wolf Island, a distance of 17 leagues.

5. **WOLF ISLAND.**—At $2\frac{1}{4}$ miles N.E. $\frac{3}{4}$ E. [*N. by E. $\frac{1}{4}$ E.*] from the north end of Wolf Island, is an insulated rock, a little above the level of the sea. Between it and the isle is a depth of 28 fathoms.

6. **CAPE ST. FRANCIS.**—The coast in the vicinity of Cape St. Francis was surveyed by Mr. J. L. Roberts, of H.M. ship *Favourite*, in 1820. At half a mile W.S.W. from the cape is *St. Francis Harbour*; and at a mile and a half north-westward from the same is *Sealing* or *Seal Bight*. St. Francis Harbour is snug and secure, but very small, and generally filled with vessels, during the fishing season, as a considerable fishery is carried on in its vicinity. Sealing Bight is more commodious; and here water may be conveniently had, but no wood.

7. **POINT SPEAR, &c.**—At a league to the north-westward of Point Spear is the common entrance to *Sophia Harbour*, *Port Charlotte*, and *Mecklenburg Harbour*, all of which have a fine depth of water for anchorage, and afford convenient shelter.

8. **ST. LUNAIRE BAY.**—The entrance of this excellent harbour is half a league to the southward of *White Cape*. It may be easily found by the remarkable whitish appearance of the cape. On the north shore, at a mile within the outer point, is *Amelia Cove*, where the most convenient anchorage may be found, in from 5 to 7 fathoms; the shore on that side is steep-to; but a cluster of islets, extending from the south shore, require a small berth. Here, in a safe and commodious roadstead, wood and water may be obtained.

9. **THE HARBOUR OF ST. ANTHONY** is a mile and a half to the westward of the cape, and cannot well be mistaken, from the remarkable high head on its southern shore. It is very secure, with good anchorage in 6 fathoms, blue clay. A few French vessels carry on the fishery here. Wood and water are abundant. *Cremalliere Cove*, at a league to the south-westward, has spacious and good anchorage in 7 and 8 fathoms, with excellent water, and plenty of fire-wood.

10. **HOME HARBOUR**, on the north side of Hare Bay, is the best harbour in the bay, and affords secure anchorage. The hills are barren, but small stunted wood may be found in the valleys.

11. **CROQUE HARBOUR.**—The entrance to this harbour bears N.W. by compass from the north end of the *Isle Groais*, which is about three leagues distant from the main land: the island is high, and 7 miles in extent in a *true* N.N.E. and S.S.W. direction. At two leagues to the southward of it is the *Southern Belle Isle*. These isles serve as a guide to the harbour. The headland forming the south side of the entrance is bare of trees, and has a round appearance, with some rocks, always visible, at about 20 fathoms to the S.E. of it. The shores of the harbour are steep-to, and a frigate may work into it. The bottom is a good holding-ground, of a slate colour. The wood in the neighbourhood is spongy dwarf-pine only.

12. **CAPE ROUGE HARBOUR** is two miles to the N.W. of Rouge Isle. The southern part is shallow and rocky, and the best anchorage is in the North Arm, the centre being too deep for convenient anchorage.

13. **FLEUR DE LYS HARBOUR** derives its name from three remarkable hillocks just over

over it. Its entrance is three miles S.S.E. from Partridge Point. It is small, but safe with all winds, and there is excellent anchorage in the N.E. Arm, in 4 fathoms. There is shoal water near and about an islet within the entrance, on the south side; on entering, therefore, you should border toward the eastern and northern shores. Wood is plenty, but water, in a dry season, is scarce. Eight or ten French vessels usually have their resort here.

14. **PACQUET HARBOUR.**—This is a small but snug harbour, having off its North Head, at the entrance, several rocks with shoal ground. It has two Arms, N.W. and S.W., both of which have deep water. A survey of it has been made by Captain H. F. Edgell, R.N., but the position has been mis-stated as $50^{\circ} 8' N.$ and $55^{\circ} 53' W.$ which should be corrected as in the table.

15. **LA SCIE** is a small harbour, $4\frac{1}{2}$ miles westward from the North Bill of St. John's; it is easy of access, but very much exposed to N.N.W. winds, which throw in a long and heavy sea, while the inner part is shoal and foul ground.

16. **NIPPERS HARBOUR**, to the north-westward of Nippers Isles, is a little confined harbour, yet the most secure on the shore of Cape St. John, with excellent anchorage in 7, and in the outer part 14 fathoms. The land around is high and barren, but well supplied with good water, and may easily be known by the isles.

17. **CUTWELL HARBOUR**, on the N.E. side of Long Island, has so spacious an entrance that the largest ships may beat into secure anchorage in from 10 to 5 fathoms, sand and mud.

The S.W. Arm has a narrow entrance of 15 feet in depth, but within are 3, 4, and 5, fathoms. Here is abundance of wood and water, with conveniences for heaving down and refitting.

18. **TRITON HARBOUR**, on the N.E. side of Great Triton Island. Its entrance lies between the isles called the Great and Little Denier: the shoals are bold and water deep, but there are coves in which secure berths may be found. The land is covered with spruce, birch, and fir, but the quantities have been much reduced by the annual cutting. Water, in general, is plentiful here.

19. **FORTUNE HARBOUR.**—This is a good but intricate harbour, the entrance being extremely narrow and dangerous, and the winds baffle from the high lands around. It is inhabited only during the fishing-season, and in the summer water is scarce.

20. **CHANGE ISLANDS TICKLE or PASSAGE**, on the north side of the Great Change Island, forms a secure harbour, with good anchorage, in 6 or 7 fathoms, mud. It contains 140 inhabitants, who carry on the fishery with success. The islets without, on the N.E., are generally low and marshy. Wood abounds, but water is scarce.

21. **FOGO HARBOUR** is very secure, and has good anchorage. This, with other harbours, has been surveyed by Mr. Tho. Smith, under the direction of Lieut. Bullock, and the particular plan is the best guide to the harbour.

22. **FUNK ISLAND.**—This islet is nothing more than a low steril rock, 100 fathoms long from east to west, and cannot be seen at more than 10 or 12 miles off. It may be easily found by the great number of sea-birds constantly hovering about it. At 60 fathoms to the northward of it is a sunken rock of 10 feet, on which the sea generally breaks; and more to the westward are two islets, called the Island Rocks, with a clear passage between, 70 fathoms in breadth.

23. **THE HARBOURS on the EASTERN COAST**, from Cape Freels, southward, are described in our '*Sailing Directory for Newfoundland*,' &c. 1837, pages 10 to 25.

24. **ST. JOHN'S, &c.**—Fort Amherst, noticed in the preceding Remarks, stands on the South Head, on the entrance of the harbour.

25. **NEWFOUNDLAND IN GENERAL.**—Of this island it has been remarked, that all its importance has arisen from its fisheries. The different settlements amount to about sixty or seventy in number, and are scattered on the eastern and southern shores, but principally the former; there are, indeed, some inhabitants on the western side, near its southern extremity, but they do not extend northward of St. George's Bay, though the vicinity of that bay has proved extremely fertile. Both the eastern and southern sides are broken by deep bays, and it is about the heads of these bays that the settlements are found.

The settlements extend almost continuously along the southern shore as far as *Fortune Bay*; and at most of the harbours there are places of worship. The settlement at St. George's Bay is perhaps

perhaps more agricultural than any other on the island. There are tracts of excellent land, with deep and fertile soils, covered in many places with heavy timber; coal, limestone, and gypsum, abound in great plenty in this part of the island. The rich pasturage which the island affords, adapts it, in an eminent degree, to the breeding and raising of cattle and sheep, insomuch as to authorize a belief that it might produce a sufficient quantity of beef to supply its fisheries. Firs of various sorts, poplars, birches, and a few maple trees, are found in Newfoundland, with a variety of shrubs, and most of the common English fruits arrive at perfection here.

St. John's is the principal settlement, and the only town in the island: it is the seat of government, and chief harbour for the British vessels. Explicit directions for entering are given in the Directory for Newfoundland. There is a light shown every night on the left [south] side of the entrance, where there are, also, a small battery and a signal post. Other batteries of greater strength, appear towering above the rocky eminences toward the north. At about two-thirds of the distance between the entrance and what may properly be termed the harbour itself, there lies a dangerous shelf called the *Chain Rock*, so named from a chain extending across the Strait at that place, to prevent the admission of any hostile fleet. Mariners on approaching the place, ought to beware of approaching too near the rocks beneath the lighthouse point.

The town forms one long straggling street, extending nearly parallel to the shore, from which branch several lanes of houses, chiefly of wood. The principal feature of the town is its multitude of wharfs and fishing stages, which entirely line the shore. The government wharf is a fine broad quay, open to the accommodation of the public. The general appearance of the town indicates exactly what it is—a mere fishing station. Its *resident* population is estimated at 11,000. The total population of Newfoundland is about 78,000.

Toulinguet, or *Twillingate Island*, in the *Archipelago of Exploits*, is the most northerly British settlement.

VARIATIONS OF THE COMPASS.—The Variations on the eastern coast of South Greenland, as found by Captain Graah, are shown in the table. More to the west, in lat. $59^{\circ} 42'$, long. 48° , it was found to be $42\frac{1}{2}^{\circ}$ W. in 1819. The variation, as found by Captain Ross, in 1818, in the middle of the entrance of Baffin's Strait, was 48° . At Port Manvers, on the coast of Labrador, Captain Manby found it to be $41\frac{1}{4}^{\circ}$ in 1808. In Sandwich Bay it was 40° in 1820. It decreases thence to the southward. Off Cape Charles the Admiralty Surveyors have lately given it as 34° ; off Cape Bauld, $31^{\circ} 54'$; at St. Lunaire Bay, 32° ; Cape Rouge to La Scie, $31\frac{1}{2}^{\circ}$; Change Isles, 29° ; Fogo Island and Cape Freels, and St. John's, 28° ; Placentia Bay, 27° ; St. Pierre, 27° ; Cape Ray, 24° ; Cow Head, 29° : but we apprehend that this is rather *more* than the true variation at the present time, *if we may judge from former results*; all of which represent it as several degrees less: but the Surveyors say that the variations near the coast, in several places, appear to be greater than those at sea; which is attributed to local magnetic attraction.

LIGHTS.—*St. John's*, a light is shown every night on the south side of the Entrance, where there are, also, a small battery and signal-post, as mentioned above; note 25.

Harbour of St. Pierre, a light-tower with harbour-light during the season of the fishery.

Light on Cape Bonaventure to Redoubt.

11. GULF AND RIVER OF ST. LAWRENCE, WITH BRETON ISLAND.

	LATIT. N.	LONG. W.	AUTHORITIES.
THE GULF [1.]	° ' "	° ' "	
ISLAND of St. PAUL [2.]			
Northern extremity	47 14 0	60 8 17	The Government Surveyors: latitudes by Captain Bayfield. (See Note 2.)
MAGDALEN ISLANDS [3.]			
Entry Isle; E. point	47 17 0	61 40 30	
Deadman Islet; W. point	47 16 8	62 12 0	
Amherst Harbour; Entrance ..	47 14 28	61 49 21	
Coffin's Island; N.E. point ..	47 37 30	61 23 0	

GULF AND RIVER OF ST. LAWRENCE, &c. CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
Northern Bird Islet	47	51	2	61	9	11	The Government Surveyors: latitudes by Captain Bayfield. (See Note 2.)
Brion or Cross Isle; E. point..	47	47	58	61	24	33	
ANTICOSTI [4.]							
East Point	49	8	45	61	42	59	The observations of Captain Henry Wolsey Bayfield, F.R.A.S. of H.M. surveying vessel <i>Gulnare</i> : 1827 to 1834.
South Point	49	3	43	62	18	30	
S.W. Point; Lighthouse.....	49	23	53	63	38	47	
Cape Henry; S.E. extremity..	49	47	50	64	25	44	
West Point; extremity	49	52	20	64	35	8	
North Point	49	57	40	63	12	0	
Observation Cape	49	38	59	62	44	24	
Bear Bay; Entrance of River..	49	30	30	62	27	29	
LABRADOR, &c. [5.]							
Bradore Harbour; flagstaff....	51	27	38	57	17	6	REMARKS. The times of high water in the river of St. Lawrence, with some general observations on the tides, are attached to the Tide Table, given hereafter; but it is particu- larly to be noticed, as shown by Captain Bayfield, that around "Point des Monts" there is little or no stream of flood, excepting very close in-shore: the downward cur- rent being constant, or very nearly so, off that point; and it requires a fast sailing vessel to beat round it against a westerly wind. Point des Monts turns this current over to the S.S.E., at a rate varying from one to two knots; so that a vessel, having a west wind, and standing over to the southward on the star- board tack, will be carried toward the south coast at a rapid rate, having the current on her weather quarter; and, during her board back to the northward, she will be retarded, the stream or current being then directly opposed to her course. When sailing at the rate of four knots, it will usually require only about half the time to go from near Point des Monts, over to the south coast, that it will take to return from the latter to the former. This circumstance it is necessary to carefully guard against, when beating up the Estuary during dark nights, and especially in foggy weather."
Mistanoque Isle, near Shecatica	51	15	51	58	15	7	
Mecatina Grand Point; S.E. extremity	50	44	10	59	2	55	
Hare Harbour; East side	50	36	32	59	20	7	
Wapitagan Harbour; islet on S. side	50	11	48	60	4	5	
Cape Whittle; S.W. isle near	50	10	44	60	9	46	
Kegashka Bay; islet on S. side	50	11	27	61	18	21	
Natashquan River; S. point ..	50	7	5	61	50	43	
Nabesippi River; point on S.E.	50	14	0	62	15	49	
MINGAN HARBOUR: Agency Ho.	50	17	20	64	4	50	
St. John's River; South point	50	17	10	64	23	16	
Point St. Charles; extremity..	50	15	25	65	51	50	
River Moisie; Entrance.....	50	11	24	66	7	41	
Carousal Isle; S. extremity....	50	5	29	66	26	35	
Bay of Seven Islands; the Store	50	13	7	66	27	7	
Point St. Margaret; extremity	50	2	33	66	47	45	
Cawie Isles; Little isle	49	49	29	67	4	57	
Egg Isle	49	38	21	67	3	10	
Trinity Cove; S.W. point	49	23	47	67	21	12	
MONT PELÉS or Point des Monts; Lighthouse.....	49	19	43	67	25	2	
—————; Southern extremity	49	18	49	67	26	22	
RIVER OF ST. LAWRENCE [6.]							
Cape Chat; Extremity	49	6	0	66	48	19	
River Matane; Entrance	48	51	43	67	34	29	
St. Nicolas Harbour; W. point	49	18	34	67	49	42	
Manicouagan Point; S.E. ex- tremity	49	6	13	68	15	0	
Bersiamites River; Entrance ..	48	55	31	68	40	30	
Jeremie Isles; Hudson's Bay Post	48	52	53	68	49	32	
Port Neuf; Church.....	48	37	25	69	9	0	
Little Metis; reef	48	41	18	68	4	39	
Mount Camille; summit (7 m. inland: 2036 ft.).....	48	28	44	68	15	55	
Father Point; Pilots' houses [6.]	48	33	30	68	30	40	
Barnaby Isle; N.E. point	48	29	43	68	35	2	
Bic Isle; S.E. Reef	48	25	17	68	51	30	

GULF AND RIVER OF ST. LAWRENCE, &c. CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.	
Tadousac, on Saguenay River.....	48	8	40	69	46	1	The Observations of Captain Bayfield, of H.M. Surveying Vessel <i>Gulnare</i> , 1827 to 1834.	
Green Island Lighthouse.....	48	3	25	69	29	14		
Brandy Pots; S.E. point	47	52	35	69	43	47		
Kamouraska; N.E. point of Crow Island	[6.]	47	35	17	69	55		48
Isle aux Coudres (Hazels); N.W. end	47	24	48	70	28	30		
Crane Island; South end	47	2	30	70	38	10		
QUEBEC; Citadel ..[6.]....	46	48	49	71	16	0		
Montreal; Cathedral....[6.]....	45	30	34	68	54	47		
NEW BRUNSWICK, &c.								
Mount Louis River; Entrance....	49	14	35	65	43	35	The mean of various Observations made by the Government Surveyors, between 1769 and 1834, compared with the Charts.	
Great Fox River	49	0	5	64	22	50		
Cape Rosier	[7.]	48	51	20	64	11		48
Cape Gaspe; Flower-pot Rock[7.]	48	45	8	64	9	34		
Douglas; the Town, south side..	48	46	24	64	21	53		
Bonaventure Isle; N.W. point..	48	29	30	64	9	21		
Cape Despair	48	25	30	64	18	30		
Point Paspebiac; S. extremity..	48	0	57	65	1	46		
Point Miscou	48	1	37	64	31	40		
Point Escuminac; High water mark	47	5	4	64	38	33		
Richibucto; Entrance ..[8.]....	46	40	0	64	37	0		
Cape Tormentin; N.E. point....	46	7	38	63	37	43		
Pictou Isle.....[9.]....	45	47	52	62	33	25	Mr. Tho. Wright, Surveyor-General of the island, &c.	
Pictou Harbour; Eastern point..	45	41	44	62	38	10		
Cape St. George	45	51	22	61	51	12		
Gut of Canso; North end	45	43	0	61	29	0		
PRINCE EDWARD ISLAND.								
East Point	[10.]	46	27	0	61	45	0	Mr. Tho. Wright, Surveyor-General of the island, &c.
North Cape	47	4	0	63	51	0		
Cape Traverse.....	46	12	0	63	28	0		
CHARLOTTE TOWN; Church	46	14	0	62	56	0		
Bear Cape	45	59	0	62	16	0		
BRETON ISLAND, &c. [11.]								
Cape North.....	47	3	0	60	20	20	Mean of the Positions assigned by Messrs. Wright, Des Barres, and Backhouse.	
Siboux Isles, at the Entrance of St. Anne's Bay	46	24	20	60	27	30		
Sydney Harbour; Lighthouse on Flat Point	46	18	15	60	8	30		
Town of Sydney; Barracks	46	9	0	60	15	30		
Scatari Isle; <i>Lighthouse</i> on the N.E. point	46	1	30	59	40	0		
Louisbourg; Beacon..[12.]....	45	54	30	59	55	30	Messrs. Chabert & Des Barres.	
Albion Cliff, on the South side of Isle Madame	[13.]	45	28	12	61	2	0	M. Des Barres, subsequently corrected.
Eddy Point; Entrance of the Gut of Canso	45	30	30	61	15	20		
Bear Head; the Islet	45	32	20	61	17	30		
Ship Harbour, in the Gut of Canso	45	36	24	61	21	25		

NOTES.

1. GULF OF ST. LAWRENCE.—Among the difficulties of the navigation in the Gulf of St. Lawrence are the fogs and ices. In spring the entrance and eastern parts of the Gulf are frequently covered with ice, and vessels are sometimes beset for many days. Being unfitted for contending with this danger, they often suffer from it, and are occasionally lost; but all danger from ice is far less than that which arises from the prevalence of fogs; these may occur at any time during the open or navigable season, but are most frequent in the early part of summer; they are rare, and never of long continuance, during westerly winds, but seldom fail to accompany an easterly wind of any strength or duration. This observation is, however, subject to restriction, according to locality or season. Thus winds between the south and west, which are usually clear weather winds above Anticosti, are frequently accompanied with fog in the eastern parts of the Gulf. Winds between the south and east are almost always accompanied with rain and fog in every part. E.N.E. winds above Point des Monts, at the mouth of the river, are often E.S.E. or S.E. winds in the Gulf, being changed in direction by the high lands of the south coast, and have, therefore, in general, the same foggy character. This is said of winds of considerable strength and duration, and which may extend over great distances. Moderate and partial fine weather-winds may occur without fog at any season, and in any locality. In the early part of the navigable season, especially in the months of April and May, with clear weather, N.E. winds are of frequent occurrence, and they sometimes occur at other seasons, in every part of the gulf and river.

The fogs sometimes last several days in succession, and to a vessel either running up or beating down, during their continuance, there is no safe guide but the constant use of the deep sea lead, with a chart containing correct soundings.

The fogs which accompany easterly gales extend high up into the atmosphere, and cannot be looked over from any part of the rigging of a ship. They, however, are not so thick as those which occur in calms after a strong wind, and which are frequently so dense as to conceal a vessel within hail; whilst the former often, but not always, admit the land or other objects to be distinguished at the distance of half a mile, or more, in the day-time.

The dense fogs which occur in calms, and even in very light winds, often extend only to small elevations above the sea; so that it sometimes happens, when objects are hidden at the distance of 50 yards from the deck, they can be plainly seen by a person 50 or 60 feet up the rigging. In the months of October and November, the fogs and rain that accompany easterly gales, are replaced by thick snow, which causes equal embarrassment to the navigator.—*Capt. Bayfield*.

2. The ISLAND OF ST. PAUL lies N. 52° E. true, ten miles from Cape North; it is about a mile and a quarter in length from north to south, and inclining to the eastward at the north end. Its average breadth is about one quarter of a mile. The margin is rocky and precipitous almost all round, indented on the N.E. and N.W. sides by two coves, in both of which boats may obtain shelter during the prevalence of certain winds. The cove on the N.W. affords a small and bold beach, about 150 feet long, where a landing may be effected, but generally with difficulty, by reason of the continual swell of the sea. The interior of the island rises into three hills, the highest being nearly in the centre, and terminating in a square summit of about 50 feet on each side, and nearly perpendicular, which is estimated to be about 258 feet above the level of the sea. The surface of the island is, in general, rocky, with some spots of marsh or bog, which probably supply the fresh water found issuing from the rock. Stunted fir and white birch trees are the only products of the isle, but some drift wood may be picked up. It is not known what animals, if any, inhabit this spot.

There is good anchorage all round the island, and close in shore, which circumstance enables vessels to lie there with any winds, by shifting their stations as the wind and weather require. The current runs generally about four miles an hour, and nearly S.S.E. —*Sailing Directory for Newfoundland, &c.* p. 52.

St. Paul's has been noted for the great number of wrecks which have been found on its shores, arising from the frequent fogs and tempestuous weather, the uncertain currents, and abrupt nature of its coast, &c.; but on this island are now two lighthouses, one near its northern and the other near its southern extremity; of which one will always be open, unless

unless to a vessel near the central rocks. The northern light, brilliant and fixed, is about 130 feet above the level of the sea ; it can be seen to the southward on any bearing excepting between N. by E. and E. by N., when it is obscured by the hills to the southward of it. The southern light may be seen from the northward on any bearing except between S.S.E. and West, when it is obscured by the hills to the northward of it. Range of light, from each tower, six leagues. Boats to render assistance, and guns for signals.

3. THE MAGDALEN ISLANDS.—Captain Bayfield places Cape Ray in longitude $59^{\circ} 20' 10''$, or three minutes west of that assigned in the Table ; and, in order to preserve the *relative* positions of the Magdalen Islands, &c. we are under the necessity of placing them three minutes to the east of that gentleman's positions. Therefore, by adding this three minutes, we gain the exact longitude assigned by Captain B., and as likewise shown in the beautiful chart of the islands, from the survey of *Lieut. P. E. Collins*, R.N. 1833.

These islands are annexed to the district and county of Gaspé, and contain a population of nearly 1000 souls, chiefly French Acadians and Catholics. Eleven English and five Irish families are settled among them, all of whom derive their principal subsistence from the fisheries. Beyond the cultivation of potato gardens, agriculture seems wholly unknown on the islands ; but natural meadows and pasturing grounds are common, and afford wholesome sustenance to a tolerable proportion of live stock. The inhabitants are, in general, remarkably hale and healthy, light in complexion, with flaxen hair. They are cheerful in character, and the females remarkably modest and ingenuous. The highest range of Fahrenheit's thermometer has been marked at 76° . It has been also observed that the islands are devoid of reptiles of any description ; and that, beside the fox, rabbits are to be found. There are two churches on the islands, and a parsonage house for the resident missionary."—(*Bouchette*, Vol. I. p. 332.)

It often happens, from the prevalence of westerly gales in the fall of the year, that ships bound to Quebec, after entering the Gulf, have been driven out again, or they have contended until their crews were worn out, and have gone to the low ports for cargoes, when, by taking an anchorage, they would have secured their passage. These islands may be approached, generally, by the lead, to 7 fathoms of water.

Brion or Cross Island. The north side has steep cliffs of red sand-stone, from which reefs extend two or three miles. Approach no nearer than in 8 fathoms. On the south side there is good shelter, with north and west winds, in 6 fathoms, sandy bottom, the east end of the island bearing E. by S., and the reef to the westward bearing west. In this road is a strong underset, which makes a ship, at her anchors, roll heavily.

The *Bird Islands* are described in the *Directory for Newfoundland*, &c. page 54.

4. ANTICOSTI.—This island, with one exception, has no bay nor harbour capable of affording shelter to shipping in general : it is uncultivated, being generally of an unpropitious soil, upon which any attempted improvements have met with very unpromising results ; yet, rude and inhospitable as its aspect may be, it is not absolutely unprovided with the means of succouring the distress of such as suffer shipwreck on its coasts, there being government-agents who reside upon it, at different stations, all the year, furnished with provisions for the use of those who have the misfortune to need them. Boards are placed in different parts, describing the distance and direction to these friendly spots : these establishments were first made in the year 1809.

"One of these provision-posts is at two leagues to the S.E. from the west end of the island, in Ellis's Cove, or Grand Bay : the second at the lighthouse at the S.W. Point, the third at Shallop Creek, otherwise called Jupiter River, and the fourth at the eastern lighthouse on Heath Point."

The south shore of the island is dangerous ; in some places there are 4 fathoms within that distance of the beach ; in others reefs of lime-stone project two or three miles. Approach no nearer than in 12 fathoms.

Ellis Cove or Grand Bay, when known, may become of general use to ships bound to Quebec. It is on the south side, about three miles from the west end of the island. To enter, you haul round the reef of Cape Henry in 5 fathoms, and keep a white cliff between two mountains ; run in with this mark until you shoalen the water to 4 fathoms. Then steer for the houses on the north side of the bay, and anchor in $3\frac{1}{2}$. The ground is here good, sheltered from all winds, excepting from S. by W. to S.W. The water being shoal, no sea comes in to endanger a ship having good ground tackle. (See further our *Directory for Newfoundland*, &c. page 55.)

5. LABRADOR:—MINGAN and ESQUIMAUX ISLES.—The Description by Captain Bayfield, dated Surveying Ship *Gulnare*, 12 Nov. 1832, is given in our *Sailing Directory for Newfoundland, &c.* 1837, pp. 57—59.

6. QUEBEC, &c.—“The latitude of Quebec is $46^{\circ} 47' 30''$, according to the observations of M. le Marquis de Lotbiniere, M. Bedard, Director of the Seminary of St. Louis, and Captain Holland. M. Mechain computed the longitude to be $71^{\circ} 10'$, by several eclipses of Jupiter's first satellite, observed by Messrs. Lotbiniere and Holland; and the passage of Venus that Captain Holland observed in 1769. All these observations, made at different times, have given very coherent results.” Vide *American Trans.* Vol. I., &c.

The above passage, from “Analysis of a General Chart,” &c., Paris, 1786, shows the position in which Quebec has been hitherto laid down on the charts; and it agrees with that given in the *Conn. des Tems*. But Quebec has been since exhibited considerably more to the eastward. Mr. Smyth, in his map of Upper Canada, has it in $69^{\circ} 52'$; the error is here enormous. Mr. Wright, in his chart of 1807, $70^{\circ} 27'$. The Requisite Tables, of 1802, give latitude $46^{\circ} 48' 38''$, longitude $71^{\circ} 5' 29''$. Colonel Bouchette, in his work on Canada, 1815, gives $46^{\circ} 48' 49''$ N. and $71^{\circ} 11'$ W.: and, although we have given Captain Bayfield's longitude in the Table, we think it highly probable that this may be too far to the west. In the years 1819, 1820, and 1821, the officers of H.M. ship *Newcastle*, provided with four chronometers, made many observations in the river; and these observations may be judged of by the longitude they placed Quebec in for three successive years, assuming Halifax as in $63^{\circ} 33' 40''$; July 16th, 1819, $71^{\circ} 12' 48''$; June 19th, 1820, $71^{\circ} 13' 14''$; July 5th, 1821, $71^{\circ} 12' 25''$. The greatest difference is 49 seconds, and the mean of the whole is one second farther west than the longitude given in 1819.

QUEBEC, &c.—The situation of Quebec, the capital of Lower Canada, and the residence of the Governor General of British North America, is unusually grand and majestic, in form of an amphitheatre. The city is seated on the N.W. side of the St. Lawrence, upon a promontory, formed by that river and the St. Charles. The extremity of this headland is called *Cape Diamond*, of which the highest point rises 345 feet above the level of the water. It is composed of a rock of gray granite, mixed with quartz crystals, (from which it obtains its name,) and a species of dark coloured slate. In many place it is quite perpendicular and bare; in others, where the acclivity is less abrupt, there are patches of brownish earth, or rather a decomposition of the softer parts of the stone, on which a few stunted pines and creeping shrubs are here and there seen; but the general aspect of it is rugged and barren.—*Bouchette*, Vol. I. 241:

Population in 1759, about 9,000; now about 28,000.

MONTREAL.—The communication between Quebec and Montreal, when not impeded by the ices, is chiefly by means of steam-vessels, which are, in general, gracefully moulded and finely finished. The cabins are fitted up with much elegance and taste; the tables are liberally provided with excellent fare, and the dessert displays the most delicious fruits of the country. Steamers start almost every day from both cities, and perform the voyage up the river in from 36 to 40 hours, but they are several hours less in accomplishing the trip downward, from the advantage of having a current setting in this direction as far as the Richelieu, where they meet with the tide.—(*Bouchette*, Vol. I. 270.)

Population of the city and suburbs, in 1825, 22,357; now not less than 25,000.

AT ST. ANNE'S, 20 leagues below Quebec, on proceeding downward, are first to be met with those insulated cliffs which characterize the scenery about Kamouraska. They are composed of granite, and generally rise in abrupt slopes, presented rugged faces, thinly clad with dwarf trees. The highest of these hills is the *Montagne Ste. Anne*, which peers above a fine country at its base. To the eastward of this are the beautiful village and settlements of the *River Ouelle*; toward the west those of *St. Roch des Aunais*; and to the southward trends a bold but not very high ridge, skirting the most luxuriant fields. At the eastern base of the mountain, very agreeably situated upon an eminence, are the small village of St. Anne, the parish church, the parsonage-house, and a large stone college, three stories high, on an elevated and salubrious spot.

River Ouelle and *Kamouraska* are the most populous villages below St. Anne's; and of the two, Kamouraska enjoys a superiority in point of magnitude as well as situation. Both villages contain several very neat dwelling houses, a few shops, and two or three good taverns. Kamouraska is celebrated for the remarkable salubrity of its atmosphere, and is now the chief watering-place of Lower Canada; as such, it is the resort of numerous visitors, of the first rank and respectability, during the summer months. East of Kamouraska the country continues for some distance singularly diversified by abrupt and insulated hills, whose craggy and almost barren

barren faces are generally contrasted with well cultivated fields. The church of St. Andrew is first seen from the westward to emerge very prettily from behind two of these cliffs. Two leagues below St. Andrew's, *Temiscouata Portage* strikes the main road; and about a quarter of a mile west of it stands an inn kept by Madame Perron. The land rises here very near the river, in a steep ascent, to an elevation of from 150 to 200 feet.

Opposite to the lower end of Hare Island, on the East, is the *River du Loup*. Upon this river are the saw-mill and extensive timber establishment of Henry Caldwell, Esq. The parishes of *Cacana*, *Isle Verte*, and *Trois Pistoles*, present themselves next in order after River du Loup. Their settlements do not extend far beyond the river or front range, which exhibits neat farm-houses, large barns, and extensive enclosures, that bear evidence of a good soil and industrious cultivation.

Father Point is a spot of much beauty, and remarkable as the place of residence of most of the pilots of the St. Lawrence, several of whom are in affluent circumstances.

Grand River Metis.—Mr. Larrive's dwelling-house and establishment stand at the mouth of the river.

Matane River.—The chief settlements occupy both banks, and extend about one mile from its mouth.

(For Sailing Directions, see our *Directory for Newfoundland, &c.*)

7. **GASPÉ BAY** has been described as the best harbour in the Gulf of St. Lawrence, the only danger to be avoided being a spit of sand on the south shore, which forms the basin. It is steep to on the east, and there can be no trusting to the lead. With a leading wind keep the north shore on board.

There are fishing establishments at *St. Peter's*, *Malbay*, and *Percée*, but the most important is at *Paspébiac*, on the northern side of Chaleur Bay. Here Robins and Co. have extensive stores; they build ships of considerable burthen, and send them, loaded with fish, to all parts of the world; and particularly to Brasil and Naples. The fishery is entirely carried on in small boats, with two men in each, who return on shore every evening, when the fish is landed and cured. At the close of the summer fishing season (from the 8th to the 15th of August), all the fish caught at the several establishments, and along the coast, is brought in, and laden on board the different ships.—*Capt. R. Fair, R.N.*—*Naut. Mag.* June, 1839.

Mal Bay, to the southward of Gaspé, is about four miles across; clean sandy bottom, good riding in ten fathoms, with the wind off shore. Should a ship be caught here with wind from the eastward, she could either run up off Gaspé Bay (if not able to clear the land), or run between Bonaventure and Percé Islets toward Chaleur Bay; only taking care to avoid the Leander Rock, which lies off Cape d'Espoir, as described in the *Directory for Newfoundland, &c.*

GRIFFIN'S COVE and **FOX RIVER**, to the N.W. of Cape Rosier, afford shelter for small vessels with a west wind, but they lie open to the north. The shore from Cape Gaspé to Cape Rosier is very steep, with high perpendicular cliffs. Should a ship run ashore here, in an easterly gale, there would be but little chance of saving lives.

8. **RICHIBUCTO**.—The depth of water at the entrance of the harbour, in 1828, was, at the best tide, 18 feet, and at the common tide $16\frac{1}{2}$. When off the harbour, in 6 or 8 fathoms of water, vessels run in by keeping two large beacons in a line, until near the sand-hill, and then run N.W. along the shore, in $2\frac{1}{2}$ to 3 fathoms of water, until they are in safety. A large buoy is laid down in 5 fathoms, outside the bar, for a guide; which buoy, from seaward, can be seen at more than a league off.

9. **PICTOU HARBOUR** is the principal port of the north coast of Nova-Scotia. It has a bar at its mouth, on which there is a depth of 22 feet at low water. Inside the Bar it becomes a capacious and beautiful basin, with 5, 6, and 9 fathoms, muddy bottom. The town is situated at about three miles from the entrance, and many houses are built of stone. It contains an episcopal, a Roman catholic, and two presbyterian, chapels. There are, also, the academy, grammar-school, court-house, and a public library. The population in 1828 was nearly 1500 souls, and it has since very rapidly increased: it cannot now be less than between 2500 and 3000. Pictou has been declared a *free warehousing port*, and its trade is very considerable in lumber, coal, and the fishery. Coasters from all parts of the Gulf of St. Lawrence resort to Pictou, and its exports have amounted to £100,000 in a single year. One hundred vessels have been loaded here with timber for Great Britain, and its exports to the West Indies were not less extensive and important.—*Bouchette*, Vol. II. p. 19.

Latterly the timber-trade of Pictou has fallen off; but the working of the coal-mines, in the immediate neighbourhood, has opened a very brisk trade in that article, which occupies some hundreds of vessels, of all dimensions, in the coasting and foreign trade, many of which carry from 500 to 700 tons, chiefly trading to the United States. The town of *New Glasgow*, in the neighbourhood of the mines, promises to be of considerable importance. There is no fishing carried on here. The country around is agricultural; and there is a quick intercourse, by steam, with Prince Edward Island.—*Colombian Navigator*, 1839, Vol. I. p. xx.

The passage into the harbour has been much facilitated by a new lighthouse, painted white, and showing a fixed light, as noticed hereafter. The roadstead is excellent; bottom of clay and mud.

10. PRINCE EDWARD ISLAND.—Of this island a copious description may be found in our *Directory for Newfoundland, &c.* It has since been noticed, that, although surrounded by Canada, Nova-Scotia, Newfoundland, &c., the climate of this island is, by many degrees, more mild and favorable than that of either of those colonies. The winter is two months shorter in duration, and the frosts much less severe, with a considerably less fall of snow. Fevers, and other diseases of the United States, are unknown here. The population of the island, according to the census of 1827, was 36,000: it is now estimated at 50,000.

11. BRETON ISLAND.—(*Bouchette*, Vol. II. 76.) SYDNEY is the shire town and capital of Breton Island. It is situated on the eastern coast of the harbour, and is a free port. The courts of justice and public offices are kept here; and here, also, the principal officers of the island reside. It contains about sixty houses, beside a government-house, stores, and barracks; likewise episcopal, Roman catholic, and dissenting, churches. The streets are regularly laid out, the houses tolerably good, and the grounds in the vicinity cultivated with some taste; so that, on the whole, it presents a pleasing appearance. The population exceeds 500.

The harbour is one of the most capacious and secure in the provinces; it is two miles wide at its entrance, four miles above which it diverges into two extensive arms, upon one of which, about seven miles from the sea, the town is built, on a peninsula, affording abundant suitable situations for wharfs, dock-yards, &c. The surrounding country is one of the finest agricultural tracts in the island: the advantages for carrying on the fishery are excellent. The principal coal-works are carried on in the neighbourhood, where useful timber abounds.

The climate of Breton Island is very similar to that of Nova-Scotia, and is considered by the inhabitants to be quite as conducive to health, and favourable to agricultural pursuits, as that of any of the British American provinces; but it is allowed that it is somewhat colder in winter and hotter in summer, more irregular, and, therefore, less pleasant than the neighbouring peninsula. The natural productions are, in all respects, similar to those of Nova-Scotia. The amount of population is about 20,000.

Too much caution cannot be exercised when approaching this island, from any direction. The currents set alternately about Cape North according to the winds at sea, both from the westward and eastward, and their effects about the Isle of St. Paul have already been noticed. It is, however, presumed that the new lighthouses will obviate much difficulty and danger in the vicinity.

12. LOUISBOURG.—A white beacon has been erected on the East head, leading into Louisbourg harbour, on the site of the old French lighthouse, which may be seen at a very considerable distance. The longitude of this spot, as obtained by the Marquis de Chabert, in 1750, was $59^{\circ} 55' W$.

13. ARACHAT, in the Isle of Madame, has been, for many years past, the seat and centre of the fishing establishments of the Jersey merchants, who export their produce hence to the West Indies, the Mediterranean, and Brasil. It is a fine harbour, accessible at all times. The town is situate on the harbour, and is fast increasing in size, appearance, and population.—(*Bouchette*, Vol. II. p. 79.) This place was constituted a free and warehousing port, by order, 13th August, 1839.

VARIATIONS OF THE COMPASS.—It has been proved, by numerous observations, made by the American surveyors, Messrs. Jos. and B. Ellicott, that the westerly variation, in 1800, ceased at or very near the River Niagara, on the south side of Lake Ontario, or longitude

longitude 79° W. See the particular plan of the Frontier of Niagara, given on the New Map of Canada, &c., published by Mr. Laurie. The variation at Montreal was $7^{\circ} 45'$ W. in 1834. In and about the same year the variations were as follow:—at Contrecoeur, $8^{\circ} 45'$: Lake St. Peter, 10° : Trois Rivieres, 11° : Quebec and Isle of Orleans, 15° : Isle aux Coudres, 16° : at Tadousac, on the mouth of the Saguenay, 17° : Off the Isle Bic, $18^{\circ} 40'$: Port Neuf, $18^{\circ} 20'$: at Father Point, $19^{\circ} 45'$: Point des Monts, 22° : Seven Isles, $20^{\circ} 27'$: West end of Anticosti, $24^{\circ} 30'$: East end, $25^{\circ} 30'$: Mingan Island, 26° : Off Kegashka, $27^{\circ} 45'$: Little Mecatina, $30^{\circ} 30'$: Bradore Harbour (Strait of Belle Isle) $34^{\circ} 15'$: Red Bay, $35^{\circ} 30'$.

At the Magdalen Isles it was 23° in 1833. Isle of St. Paul, $23^{\circ} 45'$: near Cape Ray, Newfoundland, 24° : East point of Prince Edward Island, 21° : Pictou Harbour, 19° . In Sydney River, (Breton I.) and at Cape Breton, 22 degrees.

Mr. Bain, in his '*Essay on the Variation of the Compass*,' has noticed a frequent and remarkable aberration, which has been found on approaching the vicinity of Cape Chat. He says, "In the River of St. Lawrence, the change in the variation should be most particularly attended to, as it leads a ship, both in going up and coming down, on the coast most to be avoided." Mr. B. has shown that, in coming down, in May, 1813, he found it necessary to steer a different course from the opposite one followed in going up, under very similar circumstances, a few days before. The difference exceeded a point. Both in going up and down, there was a breeze of 8 and 9 knots, weather uncommonly fine, and every circumstance extremely favorable for remarks.

Subsequent to the above period, the Zealous, ship of war, had a very narrow escape in going up the river, the compasses in the binnacle being so much affected by local attractions, that, had the fog not cleared away at the moment it did, the ship must have run on shore, not far from Cape Chat, she being in 19 fathoms. See, farther, the New Directory for Newfoundland, &c., published in 1837.

LIGHTHOUSES, &c.—GULF and RIVER of ST. LAWRENCE.

SCATARI.—A light-tower on the N.E. extremity of Scatari, first lighted December 1, 1839. Painted white, with revolving light about 90 feet above the sea; visible one minute, and invisible half a minute, alternately. A boat to render assistance to vessels in distress, and a gun to answer signals when required.

SYDNEY, BRETON ISLAND: a light-tower on Flat Point, upon the eastern side of the entrance, with brilliant fixed light, elevated 160 feet above the level of the sea, and seen, in clear weather, five leagues off.

ISLAND of ST. PAUL, off Cape North: two lighthouses, one of which had not been completed in 1839. The northern, a brilliant fixed light, as shown in the Note 2, pages 48, 49.

PICTOU.—A lighthouse, painted white, on the western side of the harbour, with fixed light. In proceeding inward by night, with a vessel of easy draught, bring the light to bear W. $\frac{1}{2}$ N., and steer for it until within about 50 fathoms off; then haul round it gradually, at about that distance, not going into less than 3 fathoms. You may anchor, if requisite, anywhere within the lighthouse, in mid-channel. The ground is excellent, and you are here secure against all winds. See further, *Colombian Navigator*, 1839, vol. i. page xxi.

ANTICOSTI: on the S.W. Point a circular stone tower, 75 feet high. The light, which is brilliant, revolves once in a minute, and can be seen from N.N.W. round by west and south to S.E. by E. The lantern is elevated 100 feet above high water; the light may be seen nearly five leagues off, when the eye is 10 feet above the sea, and at greater distances according to its elevation. Lighted every year from the 25th of March to the last day of December.

When a vessel is to the eastward of this lighthouse, she may safely stand toward the island until the light bears N.N.W. (by compass); she will then be in a good fair-way; and if requisite to make more free with the land, may do so with the lead. The land from the lighthouse trends nearly S.E. by S.

If a vessel be to the westward of the lighthouse, she may safely stand toward the coast until the light bears S.S.E. $\frac{1}{2}$ E. which will be in a good fair-way for the land, toward which she may advance as above-mentioned.

A reef of rocks projects from the S.W. point nearly west, about three-quarters of a mile; they are partly dry at low water, and require the berth of a mile from the point.

On *Heath Point*, the S.E. extremity of Anticosti, is a light-tower, similar to that on the S.W. point,

point, with a bright fixed light at 100 feet above the level of the sea, and to be seen from W.N.W. round by the South to N.E. by N.

Heath Point is low, and can be seen at the distance of a few miles only, but the *East Cape of Anticosti* is a perpendicular cliff of lime-stone, rising to the height of 100 feet. Between the two points is *Wreck Bay*, which is dangerous and affords no anchorage. The most dangerous reef on this part of the island extends E.S.E. nearly two miles from *Heath Point*. Rocky and irregular soundings, of 5 to 7 fathoms, extend nearly three miles from the same.

CAPE DES MONTS PELÉS, or *Point des Monts*, on the north side of the River of St. Lawrence, nearly opposite to *Cape Chat*; a tower, with a fixed light, at about 100 feet; lying S. 52° W. from the outer part of *Caribou Point*, over which, and eastward of it, the light may be seen.

Ships from the eastward, approaching the lighthouse, on drawing toward *Caribou Point*, may bring it to bear W. by S. when they will be in a good fair-way, and may, if requisite, advance toward land by the lead. But, after passing *Caribou Point*, on drawing toward the lighthouse, they should come no nearer than in 12 fathoms; for thus they will avoid two ledges of rocks, one of which lies E.S.E. from the lighthouse, with only 12 feet over it; the other lies S.W. from the lighthouse, and E.S.E. from the western extremity of *Point des Monts*, with 16 feet over it. These rocks are not more than half a mile from shore at low water.

From the lighthouse the western extremity of *Point des Monts* bears S. 64° W., about one mile; and, when a ship is to the westward of the Point, the lighthouse will appear in one with the outermost rocks off the same. In the day-time it forms a bold distinct land-mark, and from this line of bearing ships are in the best fair-way for proceeding up or down the river. You may, if it be required, safely approach the north shore until the lighthouse bears E. by N.; but when it bears E. $\frac{1}{2}$ N. it will be time to tack. When bearing east it will shut in with the high land, and cannot be seen to the southward of east, at only a mile from the land.

From off *St. Nicolas Harbour*, with the light bearing E. by N., the S.E. spit of *Manicougan Great Shoal*, the ship, and the lighthouse, will be all in one line of bearing.

Captain Bayfield says, 'In making the light on *Point des Monts*, remember that it is not on the extremity of the point, but has been placed (as I think very improperly) a mile and a quarter to the north-eastward, along the coast toward *Trinity Bay*.'



Lighthouse on Point des Monts, West, 1 mile.

GREEN ISLAND, in the River. On the north point of this island is a light-tower, with a *fixed light* at about 70 feet, from the 15th of April to the 10th of December.

A *FLOATING LIGHT* in the *South Traverse*, latitude 47° 22', on the edge of the bank of *St. Roque*; five miles above a chequered buoy, and three-quarters of a mile below a black buoy, on the same; also opposite to, and nearly a mile to the N.E. ward of, a white buoy on the *Middle Ground*, upon the opposite side of the channel.

The *NORTH CHANNEL* or *TRAVERSE*, which is now entirely disused by the pilots, lies along the S.E. coast of the *Isle of Orleans*, thence to *Burnt Cape*, *Cape Maillard*, *Coudre Island*, and *Cape Goose*, whence ships crossed over to the *Kamouraska Isles*, &c. In this channel the water is, in general, deep; the passage, near *Orleans*, narrow and intricate; the tides very strong; the lands high, and heavy squalls, therefore, frequent; and, lastly, few places for anchorage.

Ships arriving at Quebec, with flood-tide and an easterly wind, should take in their canvas in time, and have cable ready, as the ground in the *Basin* is not very good for holding. The water is deep, and the tides strong, particularly spring tides. If obliged to come-to in the middle, there will be found from 16 to 20 fathoms abreast of the town; but near the wharfs, or at two cables' length from them, is a depth of 11 fathoms, and here vessels are easily brought up.

12. NOVA-SCOTIA, &c. (SOUTHERN COASTS.)

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
SABLE ISLAND: [*]							
The N.E. End.....	43	59	0	59	47	0	For particulars, see the <i>Colombian Navigator</i> , 1839, vol. i. page xviii.
The Southernmost part	43	56	0	60	0	0	
The West End	43	57	0	60	15	0	
The MAIN LAND: [1.]							
Crow Harbour, in Chedabucto Bay (<i>Rook Isle</i>)	45	20	45	61	16	20	The OBSERVATIONS and SURVEYS of Jos. F. W. Des Barres, Esq., made pursuant to the orders of the Admiralty of Great Britain, 1775, with subsequent emendations.
Fox Island, in Chedabucto Bay	45	22	0	61	6	0	
Cranberry Island; Lighthouse.	45	19	20	60	57	30	
Cape Canso, or Canseau	45	18	10	60	58	20	
Canso Harbour [2.]							
Northern Entrance	45	21	0	61	1	10	
Southern Entrance	45	20	0	60	58	30	
Point Gell, near Raspberry Harbour	45	13	30	61	4	45	
Whitehead Island, off Whitehaven ..	45	10	15	61	9	20	
Berry Head, on the west side of Torbay ..	45	10	57	61	20	10	
Green Island, Country Harbour; S. point	45	4	55	61	34	40	
Cape Mocodome, on the S.W. of Country Harbour [4.]..	45	5	20	61	42	0	
White Point, on the W. side of Liscombe Harbour	44	59	2	62	0	10	
Mariet Joseph.....	44	56	40	62	3	30	
Cape Spry	44	48	25	62	34	45	
Tangier Island.....	44	44	28	62	41	10	
Jedore Head, on the West side of Jedore Harbour..[5.]..	44	40	0	63	5	30	
Shut-in Island; S.W. end....	44	36	35	63	17	50	
HALIFAX; Citadel Hill [6.]	44	39	0	63	33	40	
SAMBRO' LIGHTHOUSE, near Halifax Harbour ..[7.]..	44	28	30	63	32	30	
Holderness Island, on the S.W. side of Margaret's Bay ..	44	34	20	63	57	0	
Green Island, off Mahone Bay	44	27	0	63	58	30	
Cross Island, off Lunenburg Harbour; Lighthouse	44	23	0	64	5	10	
Cape Le Have.....	44	15	0	64	17	0	
Port Medway, S.W. Head of..	44	10	0	64	29	0	
Coffin's Island Lighthouse, near Liverpool Harbour	44	5	0	64	35	0	
Mouton or Matoon Island	43	57	0	64	42	0	
Point Hebert	43	51	0	64	51	20	
Shelburne or Cape Roseway; Lighthouse	43	40	30	65	12	35	
Cape Negro.....	43	32	0	65	17	0	
Cape Sable	43	24	0	65	35	30	
Brasil Rock	43	24	15	65	22	0	
Seal Island; Lighthouse [8.]..	43	23	54	65	58	30	
Cape Fourchu, near Yarmouth	43	47	30	66	10	30	
Cape St. Mary.....	44	5	0	66	14	0	

REMARKS.

* SABLE ISLAND.—On this island there is an establishment for the relief of shipwrecked mariners, similar to that of Anticosti, described in Note 4, page 49. For the particulars, see the *Sailing Directory for Newfoundland, &c.* p. 108.

The establishment was founded in 1803, by the Provincial Legislature, at the recommendation of the late Sir John Wentworth, then Lieut.-Governor, and has since proved the means of saving many lives.

There are now about 20 buildings on the island. The house occupied by the superintendent stands on the north side, at *eight* miles from the west end. Those uninhabited contain provisions, tinder-box, matches, &c. There are several fresh-water ponds, as shown on the particular chart, but wherever the surface is moist, fresh water may be obtained by digging from one to three feet deep.

The Signals established, and used to communicate with the island, by any vessel visiting or passing, are explained in the '*Colombian Navigator*,' 1839, vol. i., page xviii. The flag used on the island is red, white, and blue, horizontally. A gun fired, particularly in hazy weather, will draw the attention of the inhabitants.

NOVA SCOTIA, &c. (SOUTHERN COASTS,) CONTINUED.

	LATIT. N.	LONG. W.	AUTHORITIES.
Brier's Island ; <i>Lighthouse</i>	44 14 30	66 21 0	The Surveys of M. des Barres and others, with emendations, as shown in the ' <i>Colombian Navigator</i> ,' vol. i., 1839, pages x. and xxii.
Point Prim ; <i>Lighthouse</i> (Entr. of Annapolis Basin)	44 41 30	65 46 30	
Cape Split, in the Mines Channel	43 21 40	64 20 0	
Cape Chignecto	45 22 0	64 49 30	
NEW BRUNSWICK.			
Cumberland ; Fort	45 49 0	64 8 30	
Cape Enragée	45 36 0	64 28 0	
Quako Ledge, middle of	45 17 0	65 10 0	
Cape Spencer	45 12 0	65 53 30	
Cape Maspeck	45 12 40	65 58 45	
Partridge Island : <i>Lighthouse</i> ..	45 14 0	66 1 15	
CITY of ST. JOHN	45 15 30	66 1 30	
FREDERICTON, the capital of New Brunswick	45 57 0	66 39 0	
Point Lapreau ; <i>Lighthouse</i> ..	45 4 0	66 25 0	
Wolf Islands ; N.E. point	44 59 0	66 41 0	
Beaver Harbour ; S.W. point..	45 3 30	66 45 15	
Bliss Island, at the entrance of Etang	45 2 30	66 51 0	
St. Andrew's ; S.W. point of Navy Island.....	45 3 30	67 5 0	
Head-Harbour <i>Lighthouse</i> , on Campo Bello	44 57 0	66 56 0	
Grand Manan Island, &c.			
Northern Point	44 46 49	66 48 0	
White Head Island ; N.E. point	44 37 40	66 42 0	
Gannet Rock <i>Lighthouse</i> ..	44 31 0	66 49 0	

NOTES.

1. NOVA-SCOTIA, in general.—“The climate of Nova-Scotia is cold, the winter continuing from December to May. The earth is completely frozen from Christmas to April, during which period there are very heavy falls of snow. There is scarcely any spring ; for, so soon as the frost and snow disappear, vegetation revives with such vigour, as, in a few days, to alter the whole face of the country. About the first of June the fields afford sufficient food for cattle. The heat of summer is both moderate and regular, being greatest in the month of August ; and the nights are, generally, temperate. The autumn is the finest portion of the year ; the mornings and evenings are cool, the temperature of the mid-day not unlike that of June, and the sky generally clear and cloudless. The month of April and the autumnal months are the most rainy, and fogs prevail on the southern shore, and at the mouth of the Bay of Fundy in summer, but do not extend inland. The climate is remarkably healthy, and conducive to longevity. A great proportion of the inhabitants live to a very advanced age, not uncommonly to ninety and 100 years. This great longevity was also observable among the Indians. The air is pure and wholesome, and there is nothing like that noxious miasma which, in the United States, is the cause of intermittent fever. The intermittent, bilious, and yellow, fevers of America, have never appeared in the province, nor do any diseases prevail that are not usual and familiar in England. To say that the climate is not unhealthy would convey but an inadequate idea of it. It is decidedly most salubrious and congenial to the prolongation of human life, and proved by experience to be entirely beneficial to Europeans.

“The

"The natural productions of Nova-Scotia, independent of its riches in coal and minerals, consist of its timber and wild animals. The woods and timber are the same as are found in the other parts of North America:—the pine in all its varieties; the birch, which is considered as the best in America; oak, suitable for ship-building; spruce, hemlock, beech, ash, maple, and elm; all fit for boards, staves, and lumber; and an innumerable variety of other sorts of great beauty, but of minor value. The quantity of valuable timber is very great, and far from being exhausted, and enables the colonists to carry on a very extensive trade, in timber and lumber, to the mother country and the West Indies, as well as in the building and sale of ships, for which purposes it is as suitable as the timber of any other section of North America. There is a great variety of indigenous plants and flowers, some of them very beautiful, as well as of wild fruits, consisting of the sorts most common in Europe."—*Bouchette*, Vol. II. page 46.

2. CANSO HARBOUR is the harbour, or rather channel, formed by George's, formerly Canso Island. M. de Chabert, in 1750, stated this harbour to be in $45^{\circ} 20' N.$ and $60^{\circ} 55' W.$ The latitude here agrees with M. Des Barres, and the longitude is only 3 minutes more to the east. Mr. Lockwood, on the contrary, makes the latitude $2'$ more north, and the longitude $2'$ more to the west.

3. RASPBERRY HARBOUR is the PORT HOWE of the charts of M. Des Barres.—We have noticed, in a former work, that the bulk and price of the showy work of this gentleman never suffered it to come into general use; and, consequently, the new names which he assigned to different points and places have remained generally unknown. Mr. Lockwood says, "The original names of the places are restored, by which only they are known to the inhabitants and fishermen. M. Des Barres, in attaching to them the names of noblemen, and men in power, has made his charts of less value; and, in one or two instances, has created serious blunders. Inquire of the people of Jedore for Port Egmont, or those of Sheet Harbour for Port North, they know them not; nor would they ever be induced to adopt them. Jestico, a harsh, unpleasant, and unmeaning, name, is preferred to Port Hood, although the latter is more pleasing to the ear, and pronounced and recollected with ease: all attempts to change the rude Indian names for others of a finer texture have failed; even New Jerusalem and Acadia have expired."

4. CAPE MOCODOME, &c.—This cape is represented, by Mr. Lockwood, in $45^{\circ} 3' N.$ and $61^{\circ} 36\frac{1}{2}' W.$; and, in other instances, this gentleman's results differ from those of M. Des Barres; but, as we are unacquainted with the nature of his observations, we cannot with propriety substitute them for the latter, of which the particulars are known.

5. JEDORE HEAD.—In the *Colombian Navigator*, vol. i. 1839, page ix., the latitude of Jedore Head is mis-printed; it should be $44^{\circ} 40'$, as in the preceding table.

6. HALIFAX.—It may not be improper to repeat the note on Halifax, already given in the *Colombian Navigator*, as follows: "The latitude of the naval yard of Halifax, from observations very carefully made by the officers of H.M.S. *Niemen*, in 1822, was $44^{\circ} 39' 37''$. This was gained by eleven meridian altitudes with the artificial horizon, and several observations made on each side of noon at small intervals; the mean true altitudes being computed from the hour angles. The longitude $63^{\circ} 33' 43''$ was obtained as the mean result of more than thirty sets of lunar distances. These observations were made at considerable varieties of temperature, for which corrections were applied, and the index errors of the sextants were carefully ascertained at each observation.

"We formerly gave the longitude from M. Des Barres, &c., as $63^{\circ} 32' 40''$, and therefore presume that a statement of $63^{\circ} 37' 48''$, which has lately appeared, is four minutes too far west." See, further, *Colombian Navigator*, 1839, Vol. i. page xix.

7. SAMRO' Lighthouse.—Of the lighthouse, the situation, as shown by the Table, is $44^{\circ} 28\frac{1}{2}' N.$ and $63^{\circ} 32\frac{1}{2}' W.$ Mr. Lockwood gives it $44^{\circ} 28\frac{1}{2}' N.$ and $63^{\circ} 30\frac{1}{2}' W.$ We reject a recent statement of $63^{\circ} 35' 16''$.

8. SEAL ISLAND.—M. Des Barres places the southernmost point of the Southern Seal Isle in latitude $43^{\circ} 25' 25''$ and longitude $66^{\circ} 0' 35''$. Later charts have it in latitude $43^{\circ} 26' 35''$: but our friend and correspondent Lieutenant Hare gives the latitude of the south point $43^{\circ} 22' 23''$, or *four miles more to the southward*. "The latitude," says Lieut. Hare, "I had an excellent opportunity of ascertaining exactly at noon, of a very clear day, 1st of May, 1828. This result, *since confirmed*, will account for so many ships having been yearly cast away on coming out of the Bay of Fundy. On the supposition of these vessels being far enough to the southward to clear all danger, they may have bore away

to the S.E. and thus have been lost. A very strong in-draught, both on the ebb and flood, sets toward the isles, and in their vicinity, equal to 4 knots an hour, and they *should not be approached without a commanding breeze.*" See more upon this subject in Vol. i. of the *Colombian Navigator*.

VARIATIONS OF THE COMPASS.—In the year 1775, the Variations were given by M. Des Barres, as follow: North entrance of the Gut of Canso, 16° 0' W.: Crow Harbour, Chedabucto Bay, 14° 50' W.: Entrance of Liscomb Harbour, 14°: Sable Island, 13° 57': Halifax Lighthouse, 13° 35': Entrance of Shelburne, 13° 30': Cape Sable, 11° 15'.

In 1798, Mr. Backhouse, of the navy, found the variation at Halifax to exceed 16 degrees. According to Colonel Bouchette, it was 17° 0' 10" at that place in 1830: at Sambro' Lighthouse, in 1828, 16° 45'; and at Cape Sable, 14°. So that since 1775 it has increased nearly 3½ degeees; but whether it be still on the increase hereabout is questionable. At St. John's, New Brunswick, the present variation is about 16 degrees, and in Passamaquoddy Bay, 15°.

LIGHTHOUSES, &c.—NOVA-SCOTIA and NEW BRUNSWICK.

CRANBERRY ISLE, near Cape Canso, a modern light-tower, with fixed light, intended to facilitate the navigation of the Gut of Canso, to the Gulf and River of St. Lawrence, &c.

Sambro' Isle, on the west of Halifax Harbour; a round tower; brilliant fixed light at 210 feet. Attached is a small party of artillery, with two 24-pounders for signals, &c.

HALIFAX HARBOUR; Harbour-light on Maughers Beach on the east shore; Light of a red colour, at 58 feet.

Lunenburg.—Upon the S.E. point of Cross Island, at the entrance of Lunenburg Bay, latitude 44° 22', longitude 64° 6', a tower painted red, with two lights placed vertically, and 30 feet apart. The lower light is fixed, and the upper so eclipsed as to show a flash at intervals of a minute, abruptly changing from dark to light. First lighted December 1, 1839. The island is low and thickly wooded. See *Colombian Navigator*, Vol. i. 1839, page xli.

Liverpool Bay; Coffin's Island, at the entrance, a tower with revolving light, at 90 feet: time, two minutes.

Cape Roseway or Shelburne Lighthouse:—a tower, with two fixed lights; the one at 150 feet above the level of the sea, and the other 36 feet below it.

Cape Sable—Seal Island; a tower near the S.W. point, with fixed light at 80 feet.

Bryer's Island; a tower with fixed light at about 90 feet, improved by new reflectors, &c.

Annapolis; a house on Point Prim, upon the western side of the entrance, with a light at 120 feet.

Quako Head.—Latitude 45° 23', longitude 65° 20'. A lighthouse on a small rock near this head, first lighted in September, 1835. Light revolving, twice completely dark and full in every minute.

St. John's; on Partridge Island, a tower with fixed light at 120 feet; also a small light on the spit within the harbour. A bell in foggy weather.

Point Lepreau, westward of St. John's; a tower with two fixed lights; the one at 18 feet below the other. See '*Colombian Navigator*,' 1839, Vol. i. pages xli and 57.

Gannet Rock, South of Grand Manan; a tower on a rock of 40 feet in height; and now exhibiting a bright fixed light. *To be approached with caution.*

Machias Seal Isles: on the S.W. isle two light-towers, about 150 feet apart, with fixed lights at about 50 feet above high water, and bearing in a line E.S.E. and W.N.W., with the keeper's house between them.

Campo-bello; on the N.E. extremity, a harbour light for Head-Harbour, &c.

13. FREDONIA, OR THE UNITED STATES.

	LATIT. N.	LONG. W.	AUTHORITIES.
West Head, Passamaquoddy; Lighthouse	44 48 0	66 57 0	The Surveys of New Hamp- shire, &c., and Observations of the Surveyor-General, S. Holland, Esq., compared with
Petit or Little Manan; Light- house	44 24 0	67 46 0	
Mount Desert Rock; Lighthouse	43 52 0	68 3 30	

THE FREDONIAN COAST, CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
Isleboro' or Long Island, the Bay of Penobscot; [1.] South end	44	14	0	68	48	0	Observations made by M. Chabert, Dr. Williams, Dr. Winthrop, &c.
White Head; <i>Lighthouse</i>	43	59	0	68	58	0	
Portland; <i>Lighthouse</i>	43	36	30	70	10	0	
Cape Elizabeth; <i>N.E. Lightho.</i>	43	34	0	70	9	0	
Wood Island; <i>Lighthouse</i>	43	27	0	70	17	30	
Boon Island; <i>Lighthouse</i>	43	7	30	70	27	30	
Portsmouth .....[2.]....	43	4	15	70	43	15	
NEWEURY-PORT; <i>Lights</i>	42	47	45	70	46	50	The Observations of the Members of the Philadelphian Society, &c. (<i>Am. Trans.</i> Vol. I.) compared with the Topographic Surveys of Boston Harbour and the country adjacent.
Cape Anne; <i>Lights</i>	42	37	0	70	33	0	
BOSTON, Beacon Hill at	42	22	38	70	59	45	
Boston Harbour; <i>Lighthouse</i> ..	42	20	36	70	49	10	
Cambridge; Harvard College..	42	23	28	71	4	0	
Cape Cod; <i>High Lighthouse</i> ..	42	3	0	70	2	40	
PROVIDENCE; Town of [3.]..	41	50	41	71	25	20	
Montuk Point, East end of Long Island; <i>Lighthouse</i>	41	1	0	71	59	44	Inferred from the position of New York, by Mr. De Witt's Survey.
Five Islands Inlet; <i>Lighthouse</i>	40	37	10	73	12	45	
NEW YORK; Cupola of Columbia College .....[4.]....	40	42	43	74	0	11	Latitude Capt. Edw. Sabine, &c. Longitude by chronometric admeasurements, as shown in the note.
———— City Hall.....	40	42	20	74	0	15	
———— Fort Flagstaff ..	40	42	10	74	0	23	
Sandy-Hook; <i>Lighthouse</i>	40	27	30	73	59	54	Deduced from Cape Henlopen. M. de Chabert, compared with the Provincial Surveys.
Cape May; <i>Lighthouse</i>	38	57	0	74	55	45	
Cape Henlopen; <i>Lighthouse</i> [5.]	38	46	40	75	5	15	The observations of Messrs. Mason, Dixon, and Prior, on the transit of Venus, 1769, with a subsequent correction.
PHILADELPHIA; Christchurch, in Second Street [6.]	39	56	54	75	10	30	
Norriton; Observatory [7.]..	40	9	56	75	23	30	Dr. David Rittenhouse, late President of the Am. Ph. Soc., compared with Howell's Survey of Pennsylvania, &c.
Cape Henry; <i>Lighthouse</i> [8.]..	36	56	30	75	57	0	
WASHINGTON; Capitol [9.]	38	53	0	77	0	20	Latitude Captain Penrose, Lord Cochrane, and Mr. Downie, 1795: Longitude inferred from that of Washington, &c.
Cape Hatteras; <i>Lightho.</i> [10.]	35	15	0	75	31	0	
Cape Fear; <i>Lighthouse</i>	33	51	45	78	0	40	Lat. Mr. Andr. Ellicott, Surveyor to the United States. For Longitude, see Note 9.
————; S.E. Point	33	49	0	77	57	30	
George Town; <i>Lighthouse</i>	33	13	0	79	2	40	American Officers on the Survey.
Cape Roman	33	1	0	79	16	0	
CHARLESTON; <i>Lighthouse</i> [11.]	32	40	0	79	44	0	Inferred from the position of Cape Fear.
Savanna; <i>Tybee Lighthouse</i> ..	32	0	40	80	40	0	
Cumberland Island, South end; <i>Lighthouse</i> .....[12.]..	30	43	15	81	35	30	Lat. M. Chabert: Long. as above. Mr. Andr. Ellicott, Commissioner from and Surveyor to, the United States, 1800.

THE FREDONIAN COAST, CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
River Nassau; Entrance of <i>South Channel</i>	30	28	0	81	33	30	The Observations of Don José Joaquin de Ferrer, and other Spanish officers, compared with the Surveys of Messrs. Gauld, Romans, &c.
River S. Juan; Bar	30	21	0	81	32	30	
St. Augustin; <i>Lighthouse</i>	29	53	0	81	24	30	
Matanza Inlet	29	42	0	81	19	30	
Cape Canaveral; South Point	28	16	30	80	27	0	
Biscayno Kay; <i>Lighthouse</i> ..	25	39	30	80	7	0	
Great Inlet	25	1	0	80	25	0	
Looe Kay; Beacon Tower....	24	31	30	81	31	0	
Kay West; <i>Lighthouse</i>	24	29	30	81	54	0	
Sand Kay; <i>Lighthouse</i>	24	23	0	82	1	0	
Tortugas; Bush Kay <i>Lighthouse</i>	24	34	0	82	58	30	*** The Beacon Tower on Looe Kay, white, with a black staff and ball, was renewed in 1833. It is 30 feet high, and the ball is at 8 feet from its summit. See Col. Nav. Vol. I. page 208.
Tortugas Bank; Shoalest Part..	24	25	0	83	12	0	
Bar of Pensacola	30	16	30	87	33	0	
Bar of Mobile	30	9	0	88	15	0	
Balise or S.E. Entrance of the Missisipi	29	5	16	89	8	0	
New Orleans; City of..[13.]..	29	57	45	90	8	0	
Racoon Point	29	1	0	90	57	0	
Point Fierro or Defer	29	18	0	91	26	0	

NOTES.

1. ISLEBORO' or LONG ISLAND, &c.—The position of this island was determined, in 1780, by Dr. Williams, Dr. Winthrop, and other American astronomers, from a total eclipse of the sun, Sept. 27. The longitude of Boston has been given, in the Requisite Tables, as $70^{\circ} 37' 15''$. We presume that this was intended for $70^{\circ} 57' 15''$. The longitude of CAMBRIDGE was computed by M. Mechain, from two solar eclipses of 1766 and 1778, with the transit of Venus in 1769. The latitude was determined by Dr. Williams, 1784.

2. PORTSMOUTH.—The longitude of Portsmouth, by four eclipses of the first satellite of Jupiter, was communicated to the Royal Society by Captain Holland, 1774, and subsequently was thus represented in the Requisite Tables, &c.

3. PROVIDENCE.—The longitude of Providence, as computed by M. Pingré, from the transit of Venus, 1769, and as it stands in the Requisite Tables, is $71^{\circ} 22'$. This appears to be incorrect.

4. NEW YORK.—In the *Ladies' and Gentlemen's Diary*, or *United States Almanac* for 1820, Mr. Nash, the Editor, having the reputation of an excellent observer, gives particulars of a great many meridian and circum-meridional observations, taken at his School, Broadway, New York, from which he infers the latitude of No. 331, Broadway, as $40^{\circ} 42' 58''$. The difference of latitude, trigonometrically found, between Mr. Nash's and the City Hall, was somewhat less than 1300 feet; which, assumed as 13", gives the latitude of the City Hall as $40^{\circ} 42' 45''$, *i. e.* allowing $40^{\circ} 42' 58''$ as the latitude of No. 331, Broadway. By observations of a Solar eclipse, which Dr. Bowditch observed at New York, he found the difference of longitude between Greenwich and Colombia College, equal to $74^{\circ} 0' 45''$ W. On the 29th May, 1818, at a few minutes past noon, the longitude at No. 331, Broadway, by the mean of three distances of the sun and moon, appeared to be $74^{\circ} 0' 42''$, and Mr. Nash adds, "I am inclined, for the present, to place the City Hall in 74° West."

By 70 lunar distances, 40 of *Pollux* east, and 30 of *Aldebaran* west, of the moon, in December, 1822, and Jan. 1823, Captain Sabine gave the longitude of the cupola of Colombia

Colombia College, New York, as $74^{\circ} 3' 27''$; and the latitude which he assigns to it is $40^{\circ} 42' 43''$. Mr. de Witt, on his survey of the province, gave the longitude as $74^{\circ} 3'$.

The chronometers of Messrs. Arnold and Dent, however, appear to have finally decided the longitude of New York. Four of them were embarked in the *British Queen* steam-vessel, under the care of Captain Roberts, on her first voyage from England to America, in July and August, 1839, and gained the longitude of the City Hall, in New York, as $4\text{ h. } 56\text{ m. } 3\text{ s. } 35 (= 74^{\circ} 0' 49'')$. A second experiment was made on the next voyage of the same vessel, in October and November of the same year, by another set of four chronometers, and by this the difference of longitude between the Observatory at Greenwich and the City Hall, New York, appeared to be $4\text{ h. } 56\text{ m. } 0\text{ s. } 24$. Say $74^{\circ} 0' 10''$. M. Daussey, the French hydrographer, had previously given it, in the '*Connaissance des Temps*,' as $4\text{ h. } 56\text{ m. } 0\text{ s. } 72$, or $74^{\circ} 0' 11''$, and we may conclude that it does not exceed $4\text{ h. } 56\text{ m. } 1\text{ s.}$, or $74^{\circ} 0' 15''$, as shown in the Table.

The details of the two chronometrical experiments, written by Mr. Dent, and involving some interesting and important facts, are given in the '*Athenæum*,' Nos. 621 and 629, Sept. and Nov. 1839.

5. CAPE HENLOPEN.—The longitude, as given by M. de Chabert, is $75^{\circ} 12' 30''$, as since in the *Connaissance des Temps* and *Requisite Tables*. But the maps prove that this, also, is too far to the West.

6. PHILADELPHIA.—The original deduction of the longitude of Philadelphia was $75^{\circ} 13' 45''$, and of Norriton $75^{\circ} 28' 30''$, as in the *Requisite Tables*; but we have given Norriton according to its distance from Philadelphia, by Mr. Howell's Survey.

7. NORRITON is an inland town, about 16 miles to the N.W. of Philadelphia, but celebrated for the observatory of the late astronomer Dr. David Rittenhouse. See note 19, '*Colombian Navigator*,' 1839, Vol. i. page xxiv.

8. CAPE HENRY.—The result of observations made by Captain Penrose, Lord Cochrane, and Mr. Downie, of the British navy, in 1795, gave $76^{\circ} 16'$ as the longitude of Cape Henry. Mr. Chabert had previously placed it in $76^{\circ} 31\frac{1}{2}'$, as it has since stood in the *Requisite Tables*. Admiral Espinosa's chart, of 1811, places it in only $75^{\circ} 46'$; Mr. De Mayne's chart (1820) in $75^{\circ} 47'$; and we have no longer any special reason for placing it to the westward of the meridian assigned in the Table, although in a late chart it is represented in $76^{\circ} 5' \text{ W.}$

9. WASHINGTON.—As inferred from the observations made at Cape Henry, Washington was formerly placed in $77^{\circ} 14' \text{ W.}$ Dr. Bowditch's Navigation, 1817, gave it $77^{\circ} 16'$. The '*American Coast Pilot*' now gives it in $77^{\circ} 3'$, while every other modern document gives it more to the eastward. We have already shown, in the '*Colombian Navigator*,' Note 21, Vol. I., page xxiv. the reasons for adopting $77^{\circ} 0'$ as the meridian of Washington; and, by reference thereto, it will be found that the true longitude is rather to the eastward than to the westward of the same. The French tables give it as $76^{\circ} 59'$. Mr. Simeon de Witt, the able surveyor of the State of New York, as $76^{\circ} 57' 30''$.

10. CAPE HATTERAS, &c.—The correction of longitude, explained in the preceding note, continues and blends with that produced by the observations of Mr. Ellicott on Cumberland Island.

11. CHARLESTON.—We formerly stated the position of Charleston, on the authority mentioned in the *Colombian Navigator*, Vol. I. page xxv., as $32^{\circ} 40' 49''$ and $79^{\circ} 52''$, for which we now substitute $32^{\circ} 46' \text{ N.}$ and $79^{\circ} 48'$; the reasons are assigned in the same work.

12. CUMBERLAND ISLAND, &c.—It appears, upon examination, that Cumberland Island, with all the coast to the southward, was, previous to the year 1799, exhibited much too far to the westward, in all existing charts and maps. Some observations, by Mr. Charles Roberts, published in 1794, placed Cape Canaveral in $81^{\circ} 28'$, and Cape Florida in $81^{\circ} 13' \text{ West of Greenwich}$; or more than a degree to the westward of the longitude now assigned.

For the position given in the Table, we are indebted to the "*Journal of Mr. Andrew Ellicott*," commissioner on behalf of the United States, for determining the boundary of the Spanish possessions, during part of the year 1796, the years 1797, 8, 9, and part of 1800. Quarto, Philadelphia, 1803. The following are the results of the observations made for the longitude, at the south end of the island, in the year 1800.

		<i>In Time.</i>	<i>H.</i>	<i>M.</i>	<i>S.</i>
March	13. Emersion of the 1st satellite of Jupiter	5	26	29	
	15. ————— 2nd satellite	5	26	33	
	17. Lunar Observation	5	26	59	
	— Another Lunar Observation	5	26	25	
	— A third Lunar Observation	5	27	25	
	25. Emersion of the 3rd satellite of Jupiter	5	26	14	
	26. Emersion of the 4th, by the <i>Nautical Almanac</i>	5	51	48	
	by Delambre's Tables	5	27	37	
	27. Emersion of the 1st satellite of Jupiter	5	25	43	
	30. Lunar Observation	5	26	6	
April	1. Immersion of the 3d satellite of Jupiter	5	24	6	
	Emersion of the same	5	26	0	
	2. Emersion of the 2d satellite of Jupiter	5	26	49	
	5. ————— 1st satellite	5	26	40	
	9. ————— 2d satellite	5	26	57	

Thus, ultimately, the longitude, in time, was concluded to be 5 h. 26 m. 22 s. equal to $81^{\circ} 35' 30''$, and the latitude $30^{\circ} 43' 15''.8$. Our plan does not admit of a further detail of this important result. We give the example as one which, if repeatedly imitated on important points, would lead to incalculable improvements in practical geography.

The Spanish surveyors give the Bar of St. Mary's River in $30^{\circ} 45' N.$, and $81^{\circ} 32\frac{1}{2}' W.$ This, it may be noticed, corresponds very nearly with Commissioner Ellicott's determination, and it also accords with many meridional observations taken by Captain William Tulloch, of Portsmouth, in New Hampshire.

13. NEW ORLEANS, &c.—The position given in the Table was adopted by Mr. Gauld, in his Survey of West Florida, made in the years 1764 to 1771, and first published, on four sheets, in 1803. The same position has been assumed by Mr. Darby, in his Survey of Louisiana, published in 1816; but the late Spanish charts give the longitude rather more to the eastward, and the *Connaissance des Temps* gives it as only $89^{\circ} 58' 30''$. The chart of Admiral Espinosa, 1811, represents it as in $90^{\circ} 6' W.$

VARIATIONS OF THE COMPASS.—The following are the variations as given on the surveys of Samuel Holland, Esq. in 1775. It appears, from later works, that the variation in Massachusetts Bay, &c., is a degree less, at present, than when these observations were made.

Off Machias Bay, $13^{\circ} W.$: off Mount Desert Isle, $10^{\circ} 30'$; Bay of Penobscot, 10° ; near Isle Haute, 9° ; near Mauheigin Isle, and thence to Portland, $8^{\circ} 30'$: Portsmouth, $7^{\circ} 48'$: off Newburyport, $7^{\circ} 40'$: Boston Bay, $7^{\circ} 40'$: Plymouth Bay, 7° : between Nantucket and Martha's Vineyard, $6^{\circ} 30'$: off Rhode Island, $6^{\circ} W.$

The present variation at Machias Bay is $12^{\circ} W.$; Bay of Penobscot, 9° ; near Cape Elizabeth, about 8° ; at Portsmouth, 7° ; Boston and Cape Cod, about 6° ; New York Harbour, 3° ; off the Delaware, $2\frac{1}{2}^{\circ}$; and near Cape Henry, $1\frac{1}{2}^{\circ} West$. The *westerly* variation appears to cease between Cape Henry and Cape Hatteras; for near the latter the variation becomes *easterly*; and in the vicinity it is half a degree East. On the coast of South Carolina it is 3° , and at the head of the Maternillo Bank, $5^{\circ}, East$.

In 1771, Mr. Gauld gave the variation near the entrance of the Missisipi as $6^{\circ} 37' E.$ Mr. Romans, nearly at the same time, found it, near the Bay of Espiritu Santo, to be $5^{\circ} 47' E.$; and, from observations, made more to the southward, in and subsequent to 1807, we infer that it is, at present, nearly one degree more to the East. From six amplitudes taken by Captain Livingston, on his passage from and to New Orleans, in 1818, the variation on the meridian of the Dry Tortugas, in latitude $23^{\circ} 45'$, appeared to be $6^{\circ} 33' E.$ In lat. $25^{\circ} 15'$, long. $85^{\circ} 20'$, $8^{\circ} 20' E.$: in lat. $25^{\circ} 55'$, long. $85\frac{1}{2}^{\circ}$, $9^{\circ} 30' E.$; in lat. $26^{\circ} 55'$, long. $86^{\circ} 15'$, $6^{\circ} 49' E.$ We are not acquainted with the position of the ship's head at the time of observation, and, for this deficiency, due allowance must be made. At the entrance of the harbour of Mobile the variation has been given as $6^{\circ} 58' E.$ in 1828.

The discordance of numerous results of observations for variation on these coasts have occasioned the rejection of nearly one half of the number that have come to the hands of the Editor. That discordancy has undoubtedly arisen from the various positions, &c. of the ships in which the observations were made, as explained in the Appendix hereafter.

But

But it seems too that some other cause may derange the compass in particular situations. Captain Livingston has the following remarks:—

“At a considerable distance from land, or about the inner edge of the Gulf Stream, off the entrance of the Chesapeake, I saw a brigantine, apparently a very fine and fast one, steering very wild, and yawing about in almost every direction, and, for a time, I wondered much at it; but, when I had run a few miles farther north, so as to be nearly in the same position as she was when I first saw her, our compasses appeared to become perfectly useless, or so nearly useless that, having a tolerably good horse-shoe magnet on board, I touched all the three we had without effect; but, when we had run six or eight miles farther, the compasses traversed freely as before.

“Off the Chesapeake I am, therefore, convinced that something more than the iron in a vessel and her position affects the compass-needle very strongly.”—*A. L. Dec. 1817.*

PHARONOLGY OF THE UNITED STATES.

PRINCIPAL LIGHTHOUSES.—*Lights not otherwise described are of the brilliant or natural colour.* (Bearings by compass.)

NEW ENGLAND, &c.

- QUODDY HEAD, near the Scodick River; a tower, with fixed light at 90 feet; may be seen nearly seven leagues off: an alarm-bell in foggy weather, strikes ten times in a minute; heard, during calms, 5 miles off.
- Libby, or Libee South Isle, off Machias Bay; a tower, with fixed light at 60 feet.
- Moosepecky, or Moosepeak Head; three leagues S.W. $\frac{1}{2}$ W. from Libby Island Light; tower on Mistake Isle, with revolving light at 54 feet: eclipsed twice in every four minutes. At six leagues off the duration of light and dark appears nearly equal; but on approaching the darkness lessens until the greatest power of light will be, at least, as 24 to 1.
- Little Manan (not Titmanan,) near Gouldsboro' Harbour; stone tower, with fixed light, at 53 feet: five leagues to the south-westward of Moosepecky Light.
- Baker's Island, the outermost of the Cranberry Isles; tower, with fixed light at 70 feet; five leagues W.S.W. from the Little Manan.
- Mount Desert Rock; tower, with fixed light of a bright red colour, (?) at 56 $\frac{1}{2}$ feet. First lighted in August, 1830.
- Matinicus Isles, off the Bay of Penobscot: on the outer Wooden Ball Rock, two lantern lights, one at each end of a dwelling house, each at 82 feet. In a line N.N.W. and S.S.E.
- White Head, on the western side of the Penobscot; tower, with fixed light at 58 feet: seen at 4 $\frac{1}{2}$ leagues.
- Owl's Head, on the western side of the Penobscot; tower, with fixed light at 150 feet: seven miles above White Head.
- Manhegin or Monhegan Island; tower, with revolving light at 170 feet: a blood-red and brilliant light, alternately, in 2 $\frac{1}{4}$ minutes.
- Franklin's Isle, near St. George's River; tower on the north side; fixed light at 50 feet. (More properly a Harbour-light.) To be left, on entering, upon the starboard side.
- Penmaquid Point; tower, with fixed light, at 75 feet, and bearing from Manhegin light N.W. $\frac{1}{2}$ W. nearly four leagues.
- Burnt Island, near Booth Bay; tower, with fixed light at 56 feet.
- SEGWINE ISLAND, Kennebec River; tower of the first class, with fixed light at 200 feet; may be seen when nine leagues off.
- CAPE ELIZABETH; two towers, about 300 yards apart, in a line S.W. $\frac{1}{2}$ W. The N.E. light fixed; the S.W. revolving; full and obscuring alternately, in every minute and a half. Lanterns elevated 140 feet. Flashes perceptible nine leagues off.
- Portland Head; a stone tower, with fixed light at 85 feet. N. 1° E. 4 miles from Cape Elizabeth. Signals for vessels entering. (*Colombian Navigator*, Vol. I., p. 49.)
- Wood Island, Saco Bay; tower, with intermitting or flashing light at 45 feet; eclipses not total within 6 $\frac{1}{2}$ miles. Seen at seven leagues off.
- Goat Island, at the entrance of Cape Porpoise Harbour. Lighthouse for the use of vessels entering the port, as shown in the *Colombian Navigator*, Vol. I., page xlv.
- Boon Island; stone tower, on the western part; fixed light at 70 feet; seen at six leagues off.
- Portsmouth; a lighthouse on a reef called the *Whale's Back*, upon the eastern side of the entrance. It exhibits two fixed lights, one at ten feet below the other. The upper one has ten, and the lower five, lamps. The upper light is 48 feet above the level of high water, and 58 above low water. Another on the N.E. point of Newcastle Isle, upon the western side, with fixed light at 90 feet.

White Island, Isles of Shoals; tower with revolving lights at 87 feet; a bright red light, a bluish light, and a brilliant light, in $3\frac{1}{2}$ minutes. At three leagues off there appears to be a total eclipse for about 15 seconds, but the light is always visible within the distance of 3 or 4 miles. The bright light is discernible nearly seven leagues off. A bell, kept tolling in thick weather, may be heard four miles off.

Thatcher's Isle, off Cape Anne; two towers, with fixed lights, one-third of a mile apart, at about 90 feet; in a line N. by W. and S. by E. Seen at $7\frac{1}{2}$ leagues off. A signal gun, &c.

Baker's Island, off Marblehead; two towers, with fixed lights at unequal heights; in a line N.W. $\frac{1}{4}$ W. Southern or high light seen at $6\frac{1}{2}$ leagues.

BOSTON HARBOUR; Outer light on a tower of 82 feet; light revolving; bright for 40 seconds and obscured 20 seconds alternately; but at seven leagues off the interval of darkness is equal to twice the duration of light, and thence decreases on approaching, until the greatest power of the light will be to the least as 24 to 1.

Scituate; a tower on Cedar Point, with two lights; the upper one, bright, at 50 feet; the other 15 feet lower, of a blood red colour, and much broader than the upper one.

* * By mistaking this light for that of Boston, a fine brig, of 314 tons, was lost in November, 1826.

Plymouth; on the Gurnet; two fixed lights, 15 feet apart, at about 86 feet above the sea. May be seen when five leagues off.

CAPE COD, high Lighthouse, on the Clay-pounds; a tower, with fixed light at nearly 200 feet. A haze commonly over the land; and the light seldom seen at more than six leagues. For the light on *Race Point*, see 'Harbour Lights,' subjoined.

Sandy Point; the northern extremity of Nantucket Island; tower with a fixed light, at 70 feet.

Cape Poge, near the N.E. end of Martha's Vineyard; tower, with fixed light at 55 feet.

GAY HEAD; the west end of Martha's Vineyard; tower with brilliant revolving light, at 150 feet. The lights revolve once in about four minutes, and appear in full lustre twice in each revolution. At 12 miles distant they are obscured about three-fourths of the time; at three miles they may always be seen, though dimly alternately.

Clark's Point; Entrance to New Bedford; tower with fixed light, at 52 feet above high water. *Beaver's Tail*, the southern extremity of Conanicut Island; a tower with fixed light, at about 70 feet.

Point Judith, on the west side of the entrance to Narraganset Bay; a stone tower, with intermittent or flashing light, at 60 feet. The light does not wholly disappear within three leagues.

Block Island, on the N.W. point; two towers, 25 feet from each other, with fixed lights, at 58 feet, in a line bearing South, to mark the direction of the reef. The two lights cannot be made separately, when to the northward, unless in a position to make Point Judith Light N.E.

MONTUICK POINT, the eastern extremity of Long Island; a tower with fixed light, at 100 feet. Seen at 8 leagues off.

Watch Hill Point, near Westerly, Rhode Island; tower with revolving light, at 50 feet.

LONG ISLAND SOUND, &c. Fifteen Lighthouses in this Sound; described in the 'Colombian Navigator,' Vol. I., pages 88, 89, and lately inserted in the Charts.

NEW YORK, &c.

Five Island Inlet, on the south side of Long Island; a lofty tower, with revolving light at 80 feet, bearing N. 77° $35'$ E. 12 leagues from Sandy Hook. The shoal along shore extends a mile to the southward of it.

HIGH LANDS OF NEVISINK, southward of New York Harbour; two towers, 100 yards apart, with lights which, in clear weather, may be discerned at 13 leagues off. The north light is fixed, and elevated $246\frac{1}{2}$ feet above the sea. The south light, at 241 feet, revolves once in $2\frac{1}{2}$ minutes. The towers in a line bear N. 23° W.

SANDY HOOK, NEW YORK; tower, with brilliant fixed light at 90 feet. Seen at nine leagues off. Latitude 40° $27'$ $30''$, longitude 73° $59'$ $54''$; say, in practice, 74° $0'$.

CAPE MAY, Delaware; tower with a revolving light, at 75 feet, on the principle of the Boston light; a bright flash once in a minute. On a near approach it appears almost like a fixed light.

CAPE HENLOPEN; an octagonal tower, with fixed light at more than 200 feet, and seen at nine leagues. At three-quarters of a mile northward from the high light, near the sea, is a brilliant beacon-light, 35 feet high, and adapted for guiding vessels into the roads within the cape.

Smith's Island, N.E. from Cape Charles, in latitude 37° $13'$: a lighthouse, with revolving light. *Cape Henry*; lighthouse, with fixed but not strong light, at 120 feet. Near it is a house for the pilots.

THE CHESAPEAKE; the Lighthouses and Light-vessels within the Chesapeake, about fifteen in number, are described in the 'Colombian Navigator,' Vol. i., pages 109, 110.

Cape Hatteras; a tower, painted white, in latitude $35^{\circ} 14'$, with fixed light at 95 feet; seen at more than five leagues. The point now extends more than a mile from the lighthouse.

Ocracock Inlet, nine leagues S.W. by W. $\frac{1}{2}$ W. from Cape Hatteras; a tower with revolving light, at 75 feet; time, two minutes. Visible between five and six leagues off. To be left, when entering, upon the starboard side.

Cape Lookout, latitude $34^{\circ} 39'$; a tower of wood, painted in horizontal stripes, red and white, with fixed light, at 95 feet. Appears, at a distance, like a ship, with her sails clewed up.

New Inlet of Cape Fear, on *Federal Point*, upon the north side; a white tower, with fixed light at 44 feet. From the light the Bar extends E.S.E. one mile.

Bald Head of Cape Fear; a black tower, at about a mile from the sea, with a fixed light at 110 feet.

George-town Harbour, at the southern point of North Island; a round white tower, with fixed light at 90 feet.

Racon Kay, near Cape Roman; a tower, painted in horizontal stripes, black and white, light fixed, of a bright red colour, at 85 feet.

CHARLESTON, on Lighthouse Island; an intermitting or flashing light, at 85 feet: at first the interval of darkness is twice that of light, but decreases on approaching. Flashes seen at eight leagues. Within three leagues the light does not wholly disappear.

Tibee Isle, Savanna; a tower, with fixed light at 85 feet; a beacon-light, at half a mile to the eastward of it: the two in a line W. $\frac{1}{4}$ N.

Sapello Isle, Doboy Inlet; a tower, painted in horizontal stripes, red and white; revolving light at 74 feet; the time, 100 seconds: the light being full thrice in five minutes. Within three leagues the light does not totally disappear. At a distance the tower appears like a ship, with the sails clewed up.

* * In a S. by E. direction from the lighthouse, and on the northern part of Wolf Island, which forms the south side of the entrance of Doboy, are two beacon-towers, with brilliant lights and lenses, serving, by their angle of light, to direct vessels over the bar. The western or highest beacon is painted white. The eastern or lower, black. Heights from the ground, 25 and 15 feet.

St. Simon's Isle, south end; a white tower, with fixed light at 75 feet.

Cumberland Island, south end; a tower, with revolving light at 80 feet, which appears full twice in every three minutes.

St. John's River; a lighthouse rebuilding in 1839.

FLORIDA, &c.

ST. AUGUSTIN, a square tower of stone, painted white, on the northern part of the Isle of St. Anastasia; with fixed light at 75 feet. Signals as shown in '*Colombian Navigator*,' Vol. I., pages xlix., 133.

BAHAMA BANK (British). On a ridge of coral, extending from the southern extremity of *Gun Kay*, the northernmost of the Cat Kays, in lat. $25^{\circ} 34\frac{1}{2}'$, long. $79^{\circ} 18'$, a circular tower, first lighted in May, 1836. The height of the tower is 55 feet, and the light, which revolves once in a minute, is 80 feet above the level of the sea, and may be seen, from four to five leagues off, in all directions but the arc between S. by W. $\frac{1}{2}$ W. and S. $\frac{3}{4}$ E., where, at the distance of about 8 miles, it is intercepted by the Bemini Isles. See *Colombian Navigator*, Vol. I. p. xlix.)

Biscayno Kay, to the S.W. of Cape Florida; a modern tower, but light discontinued, (1839.) For the Florida light-vessel, see hereafter.

Kay West, formerly Cayo Hueso; a tower on the west end, with fixed light at 83 feet. Seen at six leagues off. On the starboard side in entering the harbour.

Sand Kay, on the Florida Reef; a tower, with revolving light at 70 feet: time, 54 seconds.

Bush Kay, one of the Dry Tortugas; a tower, with fixed light at about 65 feet. Seen from all points at four leagues.

APALACHÉ or *St. Mark's* in Florida. Lighthouse on Point Casinas, the eastern point of the entrance of the harbour, toward which it leads when bearing N.N.W. as shown in the *Colombian Navigator*, Vol. I., page i.

APALACHICOLA, *Eastern pass*, lat. $29^{\circ} 45'$, a tower first lighted in 1839; the light at 55 feet above the sea, revolves once in three minutes. A black streak is painted around the lighthouse, at 5 feet from the top, to distinguish it from those of Apalaché and St. George. To be left on entering upon the starboard side. For Directions, see *Colombian Navigator*, Vol. I., page li.

Western pass to Apalachicola. Lighthouse, with fixed light, on the western extremity of *St. George's Island*, to be left on entering upon the starboard side. Directions are given as above.

Pensacola; a lighthouse on the Barrancas, within and opposite to the mouth of the harbour, with a light at 80 feet, revolving in 70 seconds, and seen at between six and seven leagues off.

Mobile, on Mobile Point, the eastern point of the entrance, tower, with fixed light, at 55 feet. Seen at more than four leagues.

Cat Island, Entrance of Lake Borgne. A lighthouse supposed to be completed in 1839. (Particulars not received.)

MISSISSIPPI, N.E. Pass; a tower, bearing north from the mouth of the S.E. Pass, with fixed light at 78 feet. Seen at six leagues.

— *South Pass*; a tower on a bank near the south point of the Pass, painted black and white, in horizontal stripes, with revolving light; to be left, when entering, on the star-board side.

— *S.W. Pass*; a tower, painted black and white, in perpendicular stripes, with fixed light. It stands upon an islet, on the south side of the Nine Feet Channel, about three miles within the bar, on the larboard side in entering.

Point Fierro or *Fer*, on the east side of *Atchafalaya Bay*; a tower, with fixed light at 70 feet, in latitude $29^{\circ} 18'$, longitude $91^{\circ} 26'$.

HARBOUR LIGHTS.—UNITED STATES.

PENOBSCOT BAY.—On *Brown's Head*, which forms the western side of the Fox Island Passage, a small lighthouse, with fixed light at four or five rods from the shore, and 80 feet above high water mark.

Castine, on the eastern side of the Penobscot; lighthouse on *Dice's Island*, at the entrance of Castine Harbour, with fixed light, at 116 feet, and very useful to vessels running up or down the river.

Marshall's Point, at the entrance of Herring Gut, to the S.W. of the Penobscot, and N.W. of *Metinick Isle*, a fixed light, at 30 feet.

Hendrick's Head, on the eastern side, within the entrance of Sheepscut River, a fixed light at 30 feet. In running up bring the light North a little westerly.

Pond Island, in the River Kennebec, a fixed light, 52 feet above the sea, at a mile and three-quarters N. $\frac{1}{2}$ E. from Segwine Island. *Portsmouth, N. H.* two towers, described among the lights above. *Newbury-port*, two, on the south side of the entrance; fixed, at 37 feet; in one, lead into the harbour, with signals for entering. *Annis Squam*, or *Squam*; lighthouse, white, on the eastern side of the entrance; light fixed at about 50 feet. *Cape Anne*, or *Glocester Harbour*, on an islet called *Ten Pound Isle*, fixed light at 45 feet.

Long Island Light, in *Boston Harbour*, a tower, with fixed light at 80 feet. *Barnstaple Harbour*, a lantern-light upon a dwelling-house on Sandy Neck, on the west side of the entrance. *Wellfleet*, on the eastern coast of Cape Cod Bay, a fixed light on Billingsgate Island, at the entrance of the harbour. *Provincetown*, or *Cape Cod Harbour*, a fixed light, at 25 feet, upon Long Point. *Race Point* of Cape Cod, a revolving light, on the principle of that of Boston, at 25 feet: not seen until it bears S. by W. $\frac{1}{2}$ W. *Chatham Harbour*, on James' Head, two leading lights for, but now useless to, the harbour, from the increase of beach. *Monamoy Sandy Point*, harbour light, fixed, at 25 feet.

Hyannas Harbour, on the south coast of the peninsula of Barnstaple, tower of stone, on the eastern side of the entrance, painted white, with fixed light, at 70 feet. *Nobsque Point*, south-westward of Falmouth, a fixed light, at 80 feet. *Nantucket Harbour*, leading lights on the western side. *Thuckanuck light-vessel* removed from a former station to the north end of the Cross Rip, in seven fathoms. *Edgartown Harbour*, fixed light, at 40 feet, on the pier upon the western side of the entrance. *Holmes' Hole*, a fixed light on the west chop or side of the entrance, at 60 feet above the sea.

Elizabeth Isles:—A fixed light on *Cuttahunk*, the westernmost of the Elizabeth Isles, at 84 $\frac{1}{2}$ feet: another, 80 feet high, nearly upon the middle of *Nashon*, the fourth isle from the west of the same groupe, and on the west side of an indent called *Tarpaulin Cove*.

In *Buzzard's Bay*, near Roundhill Point, on the western side, a dwelling-house, upon a cluster of rocks called the *Dumplings*, shows a fixed light at 43 feet. *Clark's Point*, entrance to New Bedford, mentioned above. *Bird Island*, near Sippigan or Rochester Harbour, stone tower, with revolving light at about 30 feet. This islet is very low; the tower is white-washed; the light, elevated about 30 feet above the sea, may be seen nearly five leagues off. At first the time of total darkness is double that of light; but the interval decreases until the greatest strength of light will be as 40 to 1.

Goat Island, opposite the town of *Newport*, a fixed light at about 55 feet. *Duck Isle*, harbour light, fixed, at three miles north from that of the Beaver-tail. *Warwick Neck*, on the west side of the entrance to Providence River, harbour-light, fixed. A light-vessel at the mouth of the *Pasquotauk River*, below Providence.

NEW YORK HARBOUR: beacon-lights on the extremity of Sandy Hook; a fixed light on the eastern point of Staten Island; and another on Prince's Bay, near the S.W. point of the same island.

A light-vessel, with two lights, on the N.W. side of *Cape May Bank*. Within the Delaware the light-tower on the Brandy-wine has been undermined and destroyed; but a light-vessel is stationed on the western side of that bank; and there is, in winter, another on the upper end of the Fourteen-feet Bank; another on the east side of the Upper Middle; and there remains a har-

a harbour-light near the mouth of *Duck Creek*, upon the Delaware or western shore; and another on the spot called Mahon's Ditch, upon the opposite shore. At Lewiston, four miles W. by N. from Cape Henlopen, in winter, are two signal-lights within the piers.

On the S.E. point of *Assateague Island*, about half-way between Cape Henlopen and Cape Charles, is a fixed light, as a direction for avoiding the Chingoteake Shoals. On the N.E. end of Smith's Island, at ten miles N.E. by E. from the extremity of Cape Charles, is a revolving light.

Lights in *Pamlico Sound*: as shown in a note in the *Colombian Navigator*, Vol. I., p. 120. Within Doboy Sound, upon Wolf Island, two beacon-lights, to lead over the bar. Near an elbow off the *Carysfort Reef, Florida*, a vessel with two lights, at 50 and 60 feet above the sea; seen at four leagues off.

Port of Kay West; northern entrance. A light-vessel, about 8 miles from Kay West, at the junction of the North and N.W. channels, with one light, about 50 feet above the sea, visible three leagues off.

Lake Ponchartrain.—At the entrance of the Bayou St. Jean, 5 miles North from New Orleans, is a small fixed light at 48 feet; seen at $2\frac{1}{2}$ leagues.

14. THE BERMUDAS' OR SOMERS' ISLANDS.

	LATIT. N.	LONG. W.	AUTHORITIES.
	° ' "	° ' "	
Wreck Hill; the Western extremity of the Land	32 15 20	64 50 0	The Observations and Trigonometric Operations of the late Captain T. Hurd, R.N., who surveyed these Isles under the orders of the Admiralty, between the years 1783 and 1797.
The Long Bar; the South-western extremity of the Rocks..	32 9 0	64 57 0	
The S.W. Breaker	32 10 0	64 48 0	
The Southern extremity of the Land	32 13 12	64 46 40	In a table lately published the longitudes have been given from four to seven minutes farther West, which, as we have lately shown in the ' <i>Colombian Navigator</i> ,' may be considered as incorrect. (Vol. I., note 1, p. xvi.)
St. David's Head; the Eastern extremity of the Land.....	32 21 25	64 35 40	
Catharine Point; the Northern extremity of the Land.....	32 23 0	64 37 15	
Town of St. GEORGE	32 22 23	64 37 40	
North Rock; <i>above water</i> ...	32 29 0	64 42 50	
Mill's Breaker; the Eastern extremity of the Rocks	32 27 0	64 33 0	

NOTE.—Particular Directions for the Bermuda Isles are given hereafter; but a more enlarged description, with appearances of the land, by Lieut. Jn. Evans, R.N. is now included in the *Colombian Navigator*, above mentioned.

The VARIATION of the Compass, as observed in 1803 and 1808, was from $2^{\circ} 30'$ to $3^{\circ} W$.

15. THE BAHAMA AND PASSAGE ISLANDS.

	LATIT. N.	LONG. W.	AUTHORITIES.
	° ' "	° ' "	
LITTLE BAHAMA BANK.			Spanish Surveyors.
MATERNILLO BANK, N. end of Maternillo Reef; N.W. End [1.]	27 50 0	79 10 0	
Outer part of the Western Reef	27 34 0	79 9 0	The Surveys of Mr. Anthony De Mayne, of the British Navy, and the Observations
Memory Rock	27 5 0	79 12 0	
West End of Grand Bahama I.	26 54 30	79 2 20	
S.E. Point of Grand Bahama..	26 41 0	79 1 0	
	26 28 0	78 40 0	

THE BAHAMA AND PASSAGE ISLANDS, CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.	
	°	'	"	°	'	"		
HOLE IN THE ROCK OF WALL; Lighthouse .....[2.]..	25	51	30	77	7	45	of the Spanish surveying officers, &c., with subsequent corrections.	
N.E. Point of Abaco (<i>so called</i>)	26	19	0	76	55	0		
Elbow Reef; Outer Point	26	33	0	76	50	0		
GREAT BAHAMA BANK.								
THE SOUTHERN KAYS:								
Kay of St. Domingo	21	42	0	75	44	45	The observations of Captain Richard Owen, R.N. 1831, 1832.	
Cayo Verde, or Green Kay ..	22	1	0	75	10	0		
The Brothers; eastern rock ..	22	1	30	75	41	0		
THE JUMENTOS or YUMENTOS;								
Little Ragged Isle; beacon ..	22	9	30	75	41	30		
Ragged Island; flagstaff	22	11	40	75	42	0		
Racoon Kay; beacon	22	21	56	75	48	0		
Channel Kay	22	32	15	75	51	15		
Jamaica South Kay	22	43	56	75	53	12		
Man of War Kay; N. end	22	47	20	75	54	0		
Flamingo Kay; Hill	22	52	0	75	53	6	REMARKS.	
Water Kay; S.W. point	22	59	0	75	44	0		
N.E. Rocks	23	10	0	75	24	0		
YUMA or LONG ISLAND:								
South Point of the Isle	22	50	0	74	52	0		
Great Harbour; Entrance	23	7	0	74	52	30		
Michael Bank; 12 fathoms	23	9	15	74	45	30		
North end of the Isle	23	41	37	75	19	0		
EXUMA; the beacon	23	32	30	75	46	0		
Galliot Cut, on the Bank	23	55	0	76	15	0		
Eleuthera; S.E. Point	24	37	0	76	9	0	*** A description of, and directions for, these Isles and Passages, according with the New Surveys, are given in the copious <i>Notes</i> prefixed to the second volume of the <i>Colombian Navigator</i> , edition of 1819, pages xlii—xlvi.	
—; Governor's Harbour	25	12	0	76	15	0		
—; James Cistern	25	20	0	76	23	0		
—; Harbour Island ..	25	30	0	76	39	0		
—; Egg Island Reef;								
Extremity* .....[3.]..	25	34	0	76	55	30		
THE ISLES, &c. on the N.W.								
Fleeming Channel; the beacon	25	16	0	76	52	0		
Douglas Channel; Entrance ..	25	7	30	77	2	45		
NASSAU, New Providence;								
Lighthouse .....[4.]..	25	5	10	77	18	15	The Surveys of Mr. Anthony De Mayne, of the British Navy, and the Observations of the Spanish officers, &c., with the subsequent corrections of Captain Richard Owen, &c.	
Joulter Kays; N. extremity	25	19	0	78	8	0		
ANDROS ISLES; Morgan's Bluff								
or N.E. point	25	11	20	78	0	47		
High Kay, on the E. coast ..	24	39	30	77	41	0		
Northern Bight, or Blossom's								
Cut	24	25	0	76	46	0		
Green Kay, in the Gulf	24	2	12	77	10	0		
Berry Isles:								
S. Stirrup Kay, N.E. pt.	25	25	5	77	43	39		
Holmes' Bluff	25	37	40	77	44	0		
Gr. Stirrup Harbour; Entrance	25	48	0	77	56	0		
Great Isaac; centre ....[5.]..	26	2	0	79	5	0		
Western side of the Great Bank:								
Moselle Reef, Bemini Isles	25	50	0	79	15	0		
Gun Kay; Lighthouse ..[6.]..	25	34	30	79	18	24		

THE BAHAMA AND PASSAGE ISLANDS, CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
Cat Kays; centre	25	32	30	79	15	0	
Riding Rocks	25	11	0	79	8	0	
Orange Kays; middle	24	55	30	79	7	0	
Roquillos, or Little Rocks	24	52	0	79	8	0	
<i>Southern part of the Bank:</i>							
Guincho, or Ginger Kay	22	47	0	77	59	0	
Lebos or Wolf Kay	22	23	0	77	34	0	
Mucaras or Diamond Point [7.]	22	10	0	77	18	0	
Cayo Verde, or Green Kay	22	1	0	75	10	0	
Kay of St. Domingo [8.] ..	21	42	0	75	44	45	
The PASSAGE ISLANDS:							
Little St. Salvador; West point	24	36	22	75	58	0	
St. Salvador; Columbus or S.E. point	24	8	30	75	16	24	
———; Hawk's Nest, or S.W. point	24	8	50	75	32	30	
N.W. point	24	41	10	75	45	30	
Conception Island; S. end	23	48	46	75	6	0	
Southampton Reef; Extremity	23	56	0	75	4	0	
Rum Kay; S.E. white cliffs ..	23	38	40	74	47	20	
———; West end .. [9.] ..	23	39	0	74	56	35	
Watling's Island; large white rock at the North end	24	10	15	74	28	30	
The S.W. point	23	56	27	74	34	0	
Eastern side	—	—	—	74	24	45	
Samana or Attwood Kays:							
Eastern point	23	5	10	73	40	0	
Westernmost Reef; Extremity	23	5	50	73	50	0	
Southern Reef	23	4	45	73	45	0	
Planas or Flat Kays; centre ..	22	35	10	73	33	0	
CROOKED ISLANDS, &c.							
The N.E. breaker	22	43	30	73	47	0	
N.E. Reef; Extremity	22	47	0	73	49	45	
Mount Pisgah	22	44	10	74	7	15	
Bird Rock, off N.W. pt.	22	51	0	74	22	15	
Fortune Isle, or Long Kay; South point	22	32	0	74	23	0	
Castle Isle	22	7	0	74	18	45	
Miraporvos:*							
North Rock	22	7	50	74	32	40	
South Kay; Sand-hills	22	5	0	74	32	15	
Shoal; S.E. end	21	58	30	74	27	30	
Diana or Monkey Bank; centre	22	31	0	74	47	30	
Mariguana or Mayaguana; S.W. pt.	22	21	45	73	9	30	
Eastern end of East Reef ..	22	19	0	72	36	30	
THE CAYCOS:							
Cape Comet, the N.E. point [11.]	21	43	0	71	25	0	
Large House, near the Booby Rocks	21	49	0	71	41	0	
The Three Maries	21	57	30	72	2	30	
Providenciales; N.W. point ..	21	52	40	72	19	30	

The Surveys of Mr. Anthony De Mayne, of the British Navy, and the Observations of the Spanish Officers, &c., with the subsequent corrections of Captain Richard Owen, &c.

REMARKS.

* The MIRAPORVOS BANK and KAYS were surveyed by Mr. De Mayne in 1827. The Bank is $11\frac{1}{2}$ miles in extent from S.S.E. to N.N.W., and the shoals upon it are very dangerous, particularly to those advancing from the S.E. With the wind blowing strong from the northward they break heavily, and at all times there is a heavy swell upon them. The current generally sets from the N.E., over the shoals, at the rate of one mile an hour.

THE PASSAGE ISLANDS, CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.	
	°	'	"	°	'	"		
West or Little Cayco; S. pt. . .	21	37	0	72	27	0	The Surveys of Mr. Anthony De Mayne, of the British Navy, and the Observations of the Spanish officers, &c., with the subsequent corrections of Captain Richard Owen, &c.	
West Sand Spit	21	22	0	72	5	0		
South Shoal	21	2	0	71	41	0		
Swimmer Shoal	21	5	15	71	29	0		
The Hogsties; N.W. Kay	21	41	30	73	50	0		
GREAT INAGUA:								
The N.W. point [12.] .	21	7	30	73	39	30	REMARKS. * TURKS' ISLAND PASSAGE.—Near the S.E. end or Elbow of the Caycos Bank, is a shoal, in lat. 21° 4', long. 71° 31' 32", having over it, in some parts, only 5 feet of water, and lying with a bushy kay on the bank bearing N. by W. (by comp.) 6 or 7 miles. Lat. by merid. alt.: Long. by two good chrs., made by Barraud: one giving 71° 31' 5"; the other, 71° 32' 0".—(Edw. Dunsterville, H.M.S. <i>Carriacou</i> .)	
Middle point	21	2	0	73	41	0		
S.W. point	20	55	0	73	37	50		
Lantern Head (82 ft. high) . . .	20	56	30	73	19	24		
S.E. Point	20	58	0	73	8	0		
N.E. point	21	20	30	72	59	30		
Little Inagua; East point	21	28	30	72	55	0		
West point	21	30	0	73	4	0		
TURKS' ISLANDS:								
Endymion Reef	21	6	30	71	15	0		
Sand Kay; centre	21	11	30	71	9	0		
Salt Kay; centre	21	20	0	71	8	0		
Grand Kay; roadstead	21	28	10	71	7	30		
Square Handkerchief; N.E. detached breaker	21	6	30	70	27	20		
S.E. extremity	20	47	30	70	27	0		
Western extremity	20	56	0	70	57	0		
Augusta Reef?	20	37	30	70	13	0		
SILVER KAY OR PLATE BANK:								
East End (10 fathoms)	20	36	0	69	19	0		
S.E. point	20	15	0	69	33	0		
N.W. point	20	55	0	69	54	0		
S.W. point [13.] .	20	17	30	69	57	0		
BAJO DE NAVIDAD, or Ship Bank:								
Northern extremity [14.] .	20	14	0	68	50	0		
Eastern	20	2	0	68	45	0		
South-West	19	51	50	68	53	0		

NOTES.

1. MATERNILLO BANK AND REEF.—The Maternillo Bank, to the northward of the reef, is not represented in Mr. De Mayne's chart, although given in that of the Spanish surveyors. The water over it is deep, but appears broken; the effect of reverberating currents; especially with the wind from the northward and eastward. See, farther, *Colombian Navigator*, Vol. II. p. 125, 6.

2. ABACO LIGHTHOUSE.—Of the light-tower near the south end of Abaco, or 'Hole in the Wall,' the base is 80 feet above high water, and the tower is 80 feet high. The light revolves once in every minute, and may be seen in all directions, except where the high parts of the land intervene; and being 160 feet above the level of the sea, it will be visible, in clear weather, at the distance of 15 miles to an eye elevated 10 feet; 17 miles to one elevated 20 feet; 19 miles from 40 feet; and 21 from 80.

During ordinary winds there is good anchorage in 10 and 11 fathoms, with the light-house bearing E. by N. about half a mile from shore. The edge of the bank, to the eastward of the lighthouse, is nearly a mile and three-quarters from shore, with 23 to 16 fathoms, extending out to the S.S.E. in a tongue of soundings, with quite clear ground. (*Col. Nav.* Vol. II. p. xxxvii.)

3. **EGG ISLAND REEF.**—The *Lorton Rock*, described in the *Colombian Navigator*, Vol. II. p. 162, *does not exist*! Captain Richard Owen has shown that the vessel really struck on *Egg Island Reef*, just to the northward of Royal Island, and not more than a mile from Gauling Kay. For particulars, see *Colombian Navigator*, Vol. II., Notes, p. xlvii.

4. **NASSAU.**—The position appears to be finally settled. The Spanish surveyors gave the town as in $25^{\circ} 4' 33''$ N. and $77^{\circ} 19' 30''$ W. Mr. De Mayne as $25^{\circ} 5' 18''$ N. and $77^{\circ} 19' 19''$ W. The lighthouse, showing a harbour-light, is on the west end of Hog Island, and therefore to be left on the larboard or north side, when entering into the harbour.

5. **GREAT ISAAC.**—This islet is described in the *Colombian Navigator*, Vol. II. p. 130, but it may not be amiss to notice that it is moderately high, has several wells of fresh water, and abundance of large shell-fish. The Providence droggers water here.

6. **GUN KAY.**—The important lighthouse on this Kay has already been described in the *Pharonology*, page 65.

7. **DIAMOND POINT of the MUCARAS.**—The Mucaras, Lavanderas, and Lobos, with the dangers on the bank in the vicinity, have lately been surveyed, with great care, by Captain *Edward Barnett*, whose positions are those given in the Table. This portion of the bank was formerly represented, as in the Spanish charts, rather more to the south, and six minutes more to the east.

8. **KAY of St. DOMINGO.**—The southern part of the Great Bank, on which this kay is situate, is very dangerous by night. The kay had formerly the appearance of a sail, but, in 1835, the crew of the *Thunder* erected a beacon of stones, about 15 feet high, upon the centre of it; the other part of the kay is about 5 feet only, above water. It is a rocky arid spot, producing nothing but a little samphire and wild grass.—*Col. Nav.* Vol. II. p. xlviii.

9. **RUM KAY.**—This island has been very erroneously represented on the charts, both as to magnitude and position. The white cliffs at the S.E. end are remarkable, and may be seen six leagues off. See *Colombian Navigator*, Vol. II. p. 137.

10. **CASTLE ISLE.**—The point appears to be finally settled. Former observations gave $22^{\circ} 7' 45''$ N. and $74^{\circ} 17' 30''$ W. Mr. De Mayne as in the Table.

11. **CAYCOS.**—Captain Livingston's Remarks on the Northern Reefs of the Caycos, and the danger of approaching them, without great caution, may be found in the *Colombian Navigator*, Vol. II. page 148. Captain L. says, "I am perfectly satisfied that any vessel shaping a course from off the Rocks, to weather the N.W. point of the Caycos, by any chart hitherto published, will infallibly find himself entangled among the reefs on the west side of the Watering Bay. When a vessel once gets embayed among them, it must be next to impossible to beat out; as the reefs extending out from the land to the eastward hook suddenly round, at their outer extremity, to the southward. Thus a vessel may be in blue and deep water while the hook of the reef is outside her. I have three times examined the appearance of these reefs from the mast-heads of different vessels, and each time they appeared to me more dangerous than they had previously done."—(*This was written in 1818.*)

12. **GREAT INAGUA.**—On the S.E. coast of Inagua are several detached coral reefs about, and at some distance from, the S.E. point. On one of these H.M.S. *Statira* was lost; and on another, if not the same, the bark *Emerald*, Captain Nockells, struck, at 5 p.m. 11th June, 1834, on her passage from Jamaica to London. The bark was on it for two hours, while the small islet off the S.E. point bore West, distant four miles, and the nearest shore was five miles off. The depth of water was about 18 feet. The Captain observes that, as broken reefs may extend a long way out, vessels in passing should not advance within ten miles of the shore. The *Emerald* was so much damaged that it became necessary to abandon her; and on the next day, at 7 p.m. her crew were saved in a Spanish schooner, bound to Philadelphia, being then, with 9 feet of water in her hold, in latitude $20^{\circ} 36'$, longitude $73^{\circ} 10'$, 24 miles to the southward of Inagua.

13. **SILVER KAY BANK.**—It seems that the *Fletcher Reef*, said to have been discovered near the S.W. extremity of the *Silver Kay Bank*, in 1833, really exists on the S.W. part of that bank, the true form of which has, for the first time, been ascertained by Captain Owen and assisting officers, as now exhibited on the charts. Its N.E. side is extremely dangerous, having a cluster of rocky heads, extending 18 miles, and even with the water. There are also detached patches on the north and north-western parts.

14. The

14. The *BAJO de NAVIDAD* has been described as a fine clear bank of an oval form ; its greatest length 23 miles north and south, and eleven in breadth : the least water on it 11 fathoms, which is on the S.E. edge. The general depths 16 and 17 fathoms, very even bottom, coral and sand : the water being of a darkish hue, the bank is not easily distinguished.

VARIATIONS OF THE COMPASS.—The present variation at the Head of the *Materillo Bank* is nearly 5° E. At *Nassau*, in *Providence Island*, it was found, in 1836, to be $3\frac{1}{2}^{\circ}$ E. At *Gun Kay*, on the western side of the *Great Bank*, $4^{\circ} 30'$ E. : at the *Jumentos* and *Eleuthera*, 4° : at the *Crooked Islands* and *Watling's Island*, nearly the same : at the *Caycos* it was $3^{\circ} 10'$, and at *Turk's Islands* $2^{\circ} 54'$, 1836.

16. CUBA, JAMAICA, &c.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
S.E. AND EAST OF CUBA.							
Cape de Cruz	19	47	16	77	41	30	The officers acting under the orders of the Spanish government, for the purpose of ascertaining, by chronometers, &c. the positions of all the principal points in the West Indies; with subsequent emendations, as shown in the Notes.
Peak of Tarquino.....[1.]..	19	52	57	76	46	30	
ST. IAGO de CUBA, Morro at the Entrance	19	57	29	76	3	45	
Port Guantanamo; Entrance..	19	54	5	75	14	30	
Port Escondido; E. point	19	54	55	75	2	36	
Port Baitiqueri; Entrance	20	1	59	74	50	0	
CAPE MAYSI or MAIZE	20	13	30	74	4	30	
Port Mata; Entrance.....	20	17	10	74	12	30	
Port Baracoa; Entrance.....	20	20	50	74	21	0	
Port Maravi; Entrance	20	24	11	74	24	45	
Port Navas; Entrance	20	29	44	74	27	52	
Port Cayaguaneque; E. point.	20	30	0	74	29	27	
Port Taco; West point	20	31	17	74	33	30	
Port Jaragua; Entrance.....	20	32	44	74	36	30	
Punta (Point) de Guarico	20	39	0	74	41	0	
Port Cayo Moa; Kay.....	20	42	18	74	49	0	
Port Yaguaneque; Entrance ..	20	42	0	74	58	20	
Port Cananova; Entrance	20	41	30	75	0	0	
Port Cebollas; Entrance	20	41	52	75	3	0	
Port Tanamo; Entrance.....	20	42	41	75	14	0	
Port Cabonico; Entrance	20	42	11	75	23	40	
Port Nipe; Entrance	20	44	40	75	29	0	
Port Banes; S.E. point	20	52	50	75	36	0	
Punta (Point) de Mulas	21	7	30	75	35	0	
NORTHERN KAYS AND COAST OF CUBA.							
S. Domingo	21	42	0	75	44	45	REMARKS. We have here given the situation of all the harbours in Cuba, which have been surveyed by the Spanish officers. The latitudes are those engraved on the particular charts; but the longitudes have been subsequently rectified: those of the north coast are more to the eastward, and agree with the large general chart of the Bahama Old Channel, published by the Direccion Hidrografica of Madrid, and since in London.
Lobos or Wolf Kay	22	24	0	77	34	0	
Guincho or Ginger Kay	22	47	0	77	59	0	
Port Sama; Entrance.....	21	5	50	75	48	0	
Port Naranjo; Entrance	21	5	23	75	53	10	
Port Vita; Entrance	21	6	0	75	57	40	
Port Bariay; Entrance	21	4	9	76	1	0	
Port Jururu; Entrance	21	3	39	76	2	30	
Port Gibara; Entrance	21	6	12	76	7	0	
Port del Padre; Entrance	21	15	40	76	26	30	
Port Malagueta; Entrance....	21	17	0	76	33	0	

CUBA, JAMAICA, &c. CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
Port Manati; Entrance	21	23	44	76	44	0	Spanish Surveyors, &c.
Port Nuevitás Grandes; Entrance	21	26	50	76	51	0	
Punta (Point) Maternillos [3.]	21	39	0	76	59	30	
Cayo Romano; [4.] S.E. point	21	53	0	77	36	0	
Cayo Verde, or Green Kay.....	22	5	6	77	36	15	
Cayo Confites (<i>Sugar-Plum Kay</i>); North Point.....	22	11	44	77	40	0	REMARKS CONTINUED. The greater part of the Harbours are singularly formed, having a narrow entrance, mostly bordered with a reef or shoal, but opening into a basin inward, which affords shelter from every wind. Of such are, St. Iago, Guantanamo, Escondido, Baitiqueri, Mata, and Baracoa; but the entrance of the latter is bold-to: again, Iaco, Yaguaneque, Cebollas, Tanamo, Cabonico and Livisa, Nipe, Banes, Naranjo, Vita, Jururu, Del Padre, Malagueta, Manati, Nuevitás, Havanna, Mariel, Bahia-Honda, and Jagua.
Double-Headed Shot; [5.] N.W. Kay	23	57	0	80	21	0	
Cayo de Sal, or Salt Kay	23	39	8	80	10	0	
Cayo Cruz del Padre	23	14	0	80	57	30	
MATANZAS; Cast. de S. Severino Pan or Hill.....	23	2	54	81	34	0	
HAVANNA, Morro; Light- house	23	9	18	82	21	40	
Port del Mariel; Entrance....	23	5	58	82	42	30	
Port Cavanás; Entrance	23	4	0	82	52	30	
Bahia Honda; Entrance	22	58	49	83	6	0	
Guaijabin; Pan or Hill	22	48	0	83	22	0	
S.W. COAST OF CUBA.							
CAPE ANTONIO.....	21	54	0	84	57	30	
Cape Corrientes	21	48	30	84	29	20	
Llana or Mangrove Point	21	57	0	83	49	0	
Cape Pepe, Isle of Pines	21	29	0	83	1	0	
Bahia de Jagua or Xagua	22	1	0	80	35	37	
TRINIDAD; City of	21	42	30	80	4	0	
Puerto Casilda; Entrance	21	35	25	80	2	0	
Cayo Blanco	21	33	45	79	58	30	
Machos de Fuera.....	21	32	0	79	53	20	
Cayo Blanco de Zarza.....	21	31	40	79	44	15	
Zarza de Fuera.....	21	23	40	79	41	55	
Cayo Breton; South point....	21	3	10	79	32	42	
Boca Grande; Entrance.....	20	57	30	79	23	0	
The GRAND CAYMAN, N.E. point.....	19	22	0	81	7	0	Lat. Capt. A. Livingston, 1817: Long. Capt. Lake, R.N. and J. W. Monteath.
S.W. Kay or Point	19	14	0	81	29	0	
JAMAICA and ISLES ADJACENT [9.]							
Morant Kays, N.E. Kay.....	17	26	30	75	55	0	The mean of numerous observations, taking into account those of Messrs. Leard, Robertson, De Mayne, and Dunsterville, of Mr. F. Owen, and Captain Edw. Sabine; adjusted by the meridian of Port-Royal Dock-yard, as ascertained by Capt. Rich. Owen,
S.W. Kay.....	17	23	45	75	58	0	
Morant, or E. Pt. of Jamaica [9.]	17	56	0	76	11	19	
Yallah's Point	17	51	45	76	36	30	
Plum Point	17	55	15	76	46	55	
PORT ROYAL Dock-yard [9.]..	17	55	51	76	50	45	
KINGSTON; Church	17	57	57	76	47	35	
Portland Point.....	17	43	50	77	7	24	
Portland Rock	17	8	30	77	25	0	
Pedro Kays; N.E. Kay [11.]..	17	6	0	77	46	0	

CUBA, JAMAICA, &c. CONTINUED.

	LATIT. N.	LONG. W.	AUTHORITIES.
Pedro Bluff	17° 50' 30"	77° 47' 0"	Owen, in 1830. For particulars, see the Colombian Navigator, Vol. II., page xxxi. and the Chart of Jamaica, with its harbours, published by Mr. Laurie.
Black River; Entrance	18° 1' 10"	77° 53' 15"	
John's Point	18° 11' 30"	78° 17' 30"	
South Negril	18° 15' 45"	78° 25' 30"	
Montego Bay Point	18° 31' 30"	77° 59' 0"	
Galina Point	18° 27' 30"	76° 58' 0"	
Anotta Bay; the Town	18° 19' 0"	76° 49' 45"	
Port Antonio; Navy Island ..	18° 14' 40"	76° 31' 0"	
Formigas; N.E. part	18° 34' 30"	75° 41' 30"	
S.E. part	18° 27' 0"	75° 42' 0"	
S.W. part	18° 26' 0"	75° 51' 30"	The Survey of Captain Richard Owen, in 1835.
NAVAZA; centre of the Isle ..	18° 24' 45"	75° 3' 0"	
Baxo Nuevo; Sandy Kay [12.]	15° 53' 0"	78° 38' 30"	
Serranilla; S.W. Kay..[13.]	15° 47' 45"	79° 50' 43"	

NOTES.

1. **PEAK OF TARQUINO.**—Although we have given the Peak of Tarquino according to the Spanish authorities, there is reason for believing that it may be represented several miles too far to the southward. The peak is about 5500 feet high above the level of the sea. Captain Bird Allen has noticed that the position of the peak was determined from the ship, by observations during three days' calm, after leaving Port Royal, as latitude $20^{\circ} 3'$, longitude $76^{\circ} 51'$, or $4\frac{1}{2}$ minutes beyond that given in the Table.

2. **ST. IAGO DE CUBA.**—Mr. Nicholls, Master of the Sheerwater, brig of war, in 1819, communicated the situation of the Morro Castle of St. Iago, from observations made in that ship, as follows. Lat. observed, $19^{\circ} 57' 50''$: Long. by lunars, $76^{\circ} 2' 45''$: by chronometer, $76^{\circ} 0'$.

Captain Livingston says of this: "On the preceding communication, by Mr. Nicholls, I remark that, knowing Mr. N. to have the reputation of an excellent observer, and having, also, heard from himself, that he had, at least, one very good assistant, I place confidence in his determination."

The Spanish chart of the harbour represents the Morro as in $75^{\circ} 55' 33''$ W.; but the charts, in general, have it to the westward of the situation assigned in the Table. In the last chart it is given as $76^{\circ} 0'$.

3. **NUEVITAS.**—The channel into this harbour is to the S. by E. 4 miles from Point Maternillos. It is five miles in length, and although not, in some places, more than two cables in breadth, it forms, by its crooked shape, a convenient place of shelter. The depths within are variable, but mostly from 12 to 5 fathoms: but there seems to be a shoal spot, of 17 feet, in the middle of the entrance.

4. **CAYO ROMANO, &c.**—In the year 1781, M. le Marquis de Chabert, when proceeding from St. Domingo to the Chesapeake, had an opportunity of observing, by chronometers, the longitude of Cayo Romano, Port Matanzas, and the Pan of Matanzas; and his results were, for the first, $77^{\circ} 39' 45''$ W., and, for the last, $81^{\circ} 36' 30''$, being, in the mean, only 3 minutes to the westward of the late determinations.

5. **DOUBLE-HEADED SHOT.**—The position is given according to the last edition of the Spanish Chart of the Mexican Sea, &c. edited by the late Admiral Don José de Espinosa, first Director of the Hydrographic Establishment at Madrid. In the first edition, published (by order of the Minister of Marine, Don Juan de Langara,) in 1799, the N.W. Kay was represented in latitude $23^{\circ} 53'$, longitude $80^{\circ} 14'$. Mr. De Mayne places the N.W. Kay in $23^{\circ} 55'$ N. and $80^{\circ} 26'$ W.

This is not the only variation to be found in the different editions of the Spanish charts; even

even on points marked as determined; although the observations of the Spanish officers are generally admitted, by those who have given them an examination, to be excellent. It may not be superfluous here to notice that, the eastern extremity of Florida, in latitude $26^{\circ} 35'$, appeared in the first edition of these charts in $80^{\circ} 51' W.$; but, in the last edition, it is placed in $79^{\circ} 54\frac{1}{2}'$, or 11 minutes more to the eastward. We have followed the latter, not merely because the most recent, but because, where doubt exists, we have generally preferred that position which may be least dangerous to the navigator.

The coast being thus assumed, the Florida Kays and Reefs have been laid down from the Trigonometric Survey of Mr. George Gauld, made by order of the Lords of the Admiralty; whence it will be found that they extend 5 minutes more to the West than as represented on the Spanish Charts.

6. HAVANNA and LIGHTHOUSE.—The position formerly given was $23^{\circ} 8' 18'' N.$ and $82^{\circ} 22' 4'' W.$ The longitude being the mean of twenty results, from stars eclipsed by the moon, by Don Josef Joachim de Ferrer, in 1808, 9, 10, 11, 12; but a further rectification has given the position shown by Table. *Col. Nav.* Note 39, Vol. II., p. xxxiv.

The *Lighthouse* on the Morro, upon the eastern point of the harbour, exhibits a brilliant revolving light, which appears in its full lustre once in a minute. Although an inferior light, it may be distinctly seen, in clear weather, between $3\frac{1}{2}$ and 4 leagues off.

7. CAPE ANTONIO, ISLE of PINES, &c.—On the 12th of August, 1817, Captain Livingston came to an anchor off Cape Antonio, in 7 fathoms; and, by an excellent observation, found his latitude to be $21^{\circ} 53' 54''$; this confirms that which has been given by the Spanish officers. The longitude is well established between $84^{\circ} 57'$ and $84^{\circ} 58'$. The Baron von Humboldt gives $84^{\circ} 57'$; Captain Owen $84^{\circ} 58'$: the Spanish officers had previously given it as $84^{\circ} 57' 30''$, now confirmed.

In all the Jardines, eastward of the Isle of Pines, excellent fresh water may be found, by digging a few inches deep in the sand, at a very short distance from the sea. On the Indian Kays, the Kays of San Felipe, &c. West of the Isle of Pines, with one exception, no water is to be found. See our Chart of the Gulf and Windward Passages.

8. GRAND CAYMAN.—The latitude of the S.W. Kay of the Grand Cayman, as observed by Captain Livingston, 5th August, 1817, appeared to be $19^{\circ} 14'$, not $19^{\circ} 11'$, the parallel formerly assigned: the longitude was communicated to us by the late Captain Hurd, as a determination to be relied on, and it appears to have been confirmed by Captain J. W. Monteath, as shown in the *Colombian Navigator*, Vol. II. page 72.

The S.E. point, as communicated by Mr. Dunsterville, lies in $19^{\circ} 16' N.$ and $81^{\circ} 6' 40'' W.$ The village on the west, formerly the *Hogsties*, is now called *Georgetown*, but the most populous village is *Boddentown* on the south.

9. JAMAICA in general.—In his outline of Jamaica, 1821, Mr. De Mayne gives Morant, or the eastern point, in longitude $76^{\circ} 12'$, and South Negril, or the Western Point, in $78^{\circ} 25' W.$ By reference to the Table it will be seen that we give the one in $76^{\circ} 11' 19''$, and the other in $78^{\circ} 25' 30''$.

Mr. Leard, in his Survey of 1791, gave Morant Point in $76^{\circ} 3'$, and South Negril in $78^{\circ} 33'$; consequently he represented the island more than 15 minutes longer than it has been since exhibited; and there is reason for believing that the length is rather less than greater than that which we have given. The northern coast, it also appears, has been placed too far north from one to two miles. We have attempted to adjust these differences, still adhering to the *safe side*, on the new Chart of Jamaica and its Harbours, published by Mr. Laurie; and we give, with confidence, from several communications, Point Morant more, and South Negril less, to the West, than as shown on former charts. See, farther, the Note on Port Royal and Kingston, in Vol. II. of the *Colombian Navigator*.

10. PORTLAND ROCK.—The Portland Rock is a single Kay, 15 to 20 feet above the sea, and covered with small bushes. It has been variously represented in from lat. $17^{\circ} 7\frac{1}{2}'$ to $17^{\circ} 13'$, and from long. $76^{\circ} 32'$ to $77^{\circ} 31'$. In Mr. De Mayne's chart, it appears in $17^{\circ} 7\frac{1}{2}' N.$ and $77^{\circ} 29' W.$ The position given in our Table cannot, we think, be far from the truth. See *Col. Nav.* Vol. II. page 63.

The officers of H.M.S. *Winchester*, in 1834, by numerous altitudes, &c. gained the latitude of the rock as $17^{\circ} 7' 25''$, and long. $77^{\circ} 27' 4''$. The greatest extent of it is under two cables' length. The bottom is quite clear within three cables, the N.W. side excepted.

The best anchorage near it is in 8 or 10 fathoms, with the rock bearing East, three-quarters of a mile.—*Colombian Navigator*, Vol. III., pp. 231, 246.

11. PEDRO KAYS.—These Kays have been laid down from a late survey, as shown on the new chart of Jamaica, and they are fully described in the *Colombian Navigator*, Vol. III., p. 246.

12. BAXO NUEVO.—According to the Spanish officers, 1804, the extent of this shoal is about 7 miles from North to South, and 14 miles from East to West. All the eastern part is a reef, very steep-to; but, on the west, the depth diminishes gradually. At a mile and a half from the northern extremity, is the Sandy Kay, given in the Table. The BAXO del COMBOY, which is represented on the charts to the E.S.E. of the New Shoal, has been particularly searched for, but could not be found.

The Baxo Nuevo was examined by the officers of H.M.S. *Winchester*, in or about 1834, who described it as a belt of breakers, inside of which is smooth water, over a sandy bottom. The ship made the east side of it, the two extremities of which then appeared to bear N. by E. and S. by W. from each other, distant 3 or 4 miles. All this side presented one continual line of breakers, with here and there a small spot of sand.

The shoal was again examined by H.M. surveying ship *Thunder*, in March, 1835; the small Kay, given in the Table, was found to be about 4 feet high, and a cable's length East and West, at 6 miles N.E. from the southern breakers; it presents no appearance of vegetation, and is composed of coarse coral sand and stones.—*Col. Nav.* Vol. III. p. 247.

13. SERRANILLA.—This bank with its kays, formerly much misrepresented, lies between the parallels of $15^{\circ} 35'$ and $15^{\circ} 55'$ N. and the meridians of $79^{\circ} 41'$ and $80^{\circ} 5'$. On its eastern and southern sides are several kays and reefs. On the N.E. side is a detached patch of rocks, on which the sea constantly breaks; it is just awash, but in fine weather a rock will show about two feet out of the water: between it and the main bank is a safe passage, of not less than six fathoms, bordering close to the western side of the reef. In clear weather, by day, all the rocky patches are easily avoided, but it is very dangerous to approach by night.—*Col. Nav.* Vol. III. p. 248. (The longitude, misprinted $80^{\circ} 51'$, should be $80^{\circ} 5'$, as above.)

VARIATIONS OF THE COMPASS.—At the west end of Cuba, and about the Isle of Pines, the present variation is about 8° E. Near the east end, from 5 to 6 degrees. At the Grand Cayman 7° E. At Port-Royal, Jamaica, Mr. Leard, in 1791, gave it as $6^{\circ} 50'$ E.; but, there is reason to believe that, for a long time past, it has not exceeded $5\frac{1}{2}$ degrees. In 1824, Mr. De Mayne gave it as $4^{\circ} 40'$ only.

17. HAYTI, PORTO-RICO, and the VIRGIN ISLANDS.

	LATIT. N.	LONG. W.	AUTHORITIES.
HAYTI.			The officers acting under the orders of the Spanish Government, for the purpose of ascertaining the positions of the principal points in the West Indies, &c. with subsequent corrections.
Isle of Mona; the middle [1.]	18 6 0	67 49 0	
Isle of Saona; S.E. Point....	18 12 30	68 32 30	
Isle of Santa Catalina; West Point	18 19 0	69 2 0	
CITY of St. DOMINGO ..[2.]..	18 28 15	69 58 0	
Punta de Salinas	18 12 0	70 49 30	
Alto-vela, or Little Mount [2.]	17 28 20	71 40 0	
Cape Jaquemel or Jacmel	18 10 20	72 33 15	
Aquin Bay; the Diamond Rock	18 13 48	73 20 0	
St. Louis; the Old Fort	18 14 27	73 31 30	
Les Cayes; the Town.....	18 11 10	73 44 0	
Isle a Vache; East Point	18 4 0	73 34 30	
Point Abacou	18 1 0	73 46 0	REMARKS. The results, generally, exhibit the longitudes to the eastward of the situations formerly assigned, although many observations had been previously made by scientific observers. The latitudes found by M. Puysegur, in his Surveys of the northern
Point à Gravois	18 1 20	73 55 30	

HAYTI, PORTO-RICO, &c. CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
CAPE TIBURON; extremity....	18	19	25	74	27	32	The observations of the Spanish Officers, &c.
Point des Irois.....	18	23	20	74	29	30	
Isle of Navaza; middle.. ...	18	24	45	75	3	0	REMARKS CONTINUED. northern coasts, made by order of Louis XVI., in 1784 and 1785, have been mostly verified; but the longitudes are from 4 to 6 minutes more to the East. Some previous observations had also been made by Messrs. Fleuriu, Verdun, Borda, and Pingré, in their most useful voyages, made for determining various points of the Atlantic, already mentioned in some preceding notes; but the whole has been rectified in the course of the later operations. The Points of the Western Coast were confirmed, generally, by Mr. Edw. Dunsterville, the active and intelligent master of H.M. sloop <i>Bustard</i> , in 1826 and 1827.
Cape Dame Marie, or Donna Maria	18	37	25	74	25	0	
Port Jeremie	18	39	57	74	6	0	Mr. Edw. Dunsterville, &c.
Pirogues, on the Rochelois Reef	18	37	20	73	12	0	
Hummock of Petit Goave	18	26	51	72	50	30	The observations of the Spanish Officers, as already explained; particularly those of Captains Don Cosmé de Churruca and Francisco Fidalgo, &c.
Isle of Gonave; East Point ..	18	43	45	72	47	30	
PORT AU PRINCE; the Road..	12	33	12	72	22	25	For some important remarks on the navigation about Porto-Rico, with a table of observations on the Caribbee Islands, &c. by <i>Captain Zhartmann</i> , Hydrographer of the Danish Royal Navy, see <i>Colombian Navigator</i> , vol. III. pp. xix. xx.
Arcadins; Southernmost	18	45	0	72	37	30	
St. Marc or St. Mark's Point ..	19	2	10	72	49	0	Observations of the Spanish and Danish officers, compared with the chart by Mr. R. H. Schomburgk, 1832.
Port à Piment	19	35	0	72	57	18	
St. Nicolas Mole Point	19	49	40	73	25	30	
Port à l'Ecu	19	55	10	73	5	30	
Port Paix; Carenage Point....	19	57	0	72	45	15	
Tortue or Tortuda Isle; West Point	20	5	20	72	54	56	
East Point ..	20	3	33	72	34	10	
CITY OF CAPE HAYTIEN	19	46	30	72	12	40	
The Grange Point	19	54	45	71	40	0	
Point Isabelica	19	58	40	71	6	30	
Old Cape François	19	40	30	69	55	30	
Cape Cabron	19	22	0	69	12	50	
Cape Samana	19	15	40	69	6	15	
Cape Raphael	19	2	0	68	52	0	
Cape Enganno	18	34	30	68	20	30	
Point Espada	18	19	48	68	30	0	
ISLAND OF PORTO-RICO.							
Cape St. Juan, or N.E. Point ..	18	24	20	65	39	0	
MORRO CASTLE of ST. JUAN [3.]	18	29	0	66	7	0	
Point Bruguen, or N.W. Pt. ..	18	31	18	67	7	0	
Isle Desecho or Zacheo	18	23	48	67	27	40	
Aguadilla Town	18	25	10	67	7	17	
Point Algarroba	18	14	0	67	7	30	
Puerto Guanica; East Point ..	17	57	44	66	52	45	
Caxa de Muertos, or Coffin; S.W. Point	17	50	30	66	35	0	
THE VIRGIN ISLANDS.							
Anegada; N.W. point	18	50	0	64	27	0	
[5.] S.E. point	18	43	48	64	16	30	
Horse-shoe Reef; South end ..	18	34	0	64	13	30	
Virgin Gorda; East pt.	18	31	7	64	21	30	
Ginger Isle; centre	18	24	30	64	30	0	
Tortola; Road Town	18	26	0	64	39	0	

THE VIRGIN ISLANDS, CONTINUED.

	LATIT. N.	LONG. W.	AUTHORITIES.
St. John's; S.E. point	18 19 0	64 44 20	Observations of the Spanish and Danish officers, compared with the chart by Mr. R. H. Schomburgk, 1832.
Sta. Monica Rock (9 feet)	18 19 0	64 39 30	
St. Thomas Harbour; Fort Christian .....[6.]..	18 21 16	64 57 15	
The Bergantin or Curvel	18 18 0	65 7 0	
ST. CROIX or SANTA CRUZ:			A communication made to Mr. Edw. Dunsterville, by Sir Andrew Lang, of St. Croix, 21st January, 1832.
Eastern extremity of the Island [7.]	17 45 35	64 38 0	
The Lang Observatory ..[8.]..	17 44 32	64 40 43	<p>*** The general height of the tops of the hills in St. Croix is from 800 to 850 English feet above the level of the sea, excepting toward the northern side of the north-western district of the island, where they ascend higher, and the highest of which, called <i>Mount Eagle</i>, is 1156 feet above the level of the sea. Its summit is in latitude 17° 45' 52", and longitude 64° 48' 31".</p> <p>Along the greater part of the south side of the island, a ledge of reefs lines the coast, at a distance from shore, in some places, of less than a mile. There are a few channels through these reefs, practicable for small vessels only.—<i>Andr. Lang.</i></p>
Harbour of Christianstæd; Flag-staff of the outer point battery, called <i>Fort Louisa Augusta</i> [9.]	17 45 28	64 43 32	
Fort Christiansværn, in the town of Christianstæd; Flag-staff	17 44 59	64 41 58	
Salt River Point .....[10.]..	17 47 12	64 44 45	
Hams or N.W. Bluff ..[11.]..	17 46 20	64 52 3	
Fort at Frederikstæd or West End; Flag-staff ....[12.]..	17 43 0	64 52 41	
Sandy Point; the S.W. extremity of the island ...[13.]..	17 40 30	64 53 48	
Buck Isle; Eastern extremity ..[14.] Northern extremity	17 47 18	64 36 40	
Summit, about 350 feet above the level of the sea....	17 47 30	64 37 37	
	17 47 15	64 37 3	

NOTES.

1. *MONA*.—A particular description and view of this island are given in the *Colombian Navigator*, Vol. I, page 9. Fresh water may be obtained here.

2. *ALTO-VELA*, or *LITTLE MOUNT*.—This is a high rocky islet, which serves as a general point of departure to all ships bound from the eastward to Jamaica, &c. It is peaked, and appears to the northward, at a distance, like a dome, emerging above a mist or fog. See, further, the Book of Directions above mentioned.

On the authority of the late respected and scientific Admiral Espinosa, of the Spanish navy, we formerly gave *Alto-vela* in longitude 71° 22' W. instead of a more westerly position, which had previously been assigned: but it is now fully proved that this is wrong, and that the true longitude is 71° 40' or 71° 41' W.

In several voyages to Jamaica, Captain J. S. Park, in the ship *Carshalton Park*, has uniformly made *Alto-vela*, both by lunars and chronometers, 19 or 20 minutes to the westward of the longitude given on the authority of the Spanish observers. "The first time Mr. Park perceived this great difference, he suspected that there must be something incorrect in his own calculations: even the next voyage, when he passed it again, and found the same difference, he still thought he must be in error: but he has discovered the same thing so often, in succeeding voyages, as to leave little doubt on the subject."

Captain Loudon, of Liverpool, has three times made *Alto-vela* in 71° 39' W., and last time 71° 39' 30", on his passage from *Deseada*.

We have other communications on this point, which do not require a particular detail; and therefore submit the following general statement.

The Count de Chastenet Puysegur, 1785, gave Alto-vela in.....	71° 46' 0"
Mr. James Henderson, Master of H.M. ship <i>Druid</i> , 1826	71 46 0
Capt. Henry Turner, of the <i>John Renwick</i> , of London, 1828	71 44 30
1829	71 42 30
Lieut. John Steele Park, R.N. in the <i>Carshalton Park</i> , 1827	71 41 30
Captain Loudon, of the <i>Marmion</i> , of Liverpool.....	71 39 0
Two friends of Captain Loudon.....	71 39 30
The French Tables, <i>Connaissance des Temps</i> , 1826	71 38 45
Mr. Edw. Dunsterville, Master of H.M. sloop <i>Bustard</i> , 1826	71 38 0
The same; Master of H.M.S. <i>Ranger</i> , in 1829.....	71 40 50
Mr. John Leard, Surveyor of Jamaica, 1792.....	71 32 0
Captain Rd. Owen, H.M.S. <i>Thunder</i>	71 39 30
Mean longitude of the whole.....	71 40 4

3. MORRO OF ST. JUAN.—The harbour of St. Juan was surveyed by Don Cosme de Churruca, in 1794. The position given in the Table is from the statement of Don Josef Cerquero, director of the Royal Observatory in the Isle of Leon, near Cadiz. The particulars are given in the *Colombian Navigator*, Vol. II. page xvi.; and the longitude, as there noticed, is considered as one of the best established in America.

4. AGUADILLA.—The situation of Aguadilla, as given by the Spanish officers, is $18^{\circ} 25' 53''$ N., and $67^{\circ} 6' 20''$ W. Admiral Mackellar gives it as $18^{\circ} 24' 57''$ N., and $67^{\circ} 8' 15''$ W. In this, as in some other instances, the mean of the two is the position given in the Table.

5. ANEGADA with its reefs were surveyed by Mr. Robert Herman Schomburgk, in 1832. We formerly enumerated, in the description of the Caribbean Isles, the number of wrecks that lay upon the reefs in 1811; and Mr. Schomburgk has noticed that, between 1811 and 1832, twenty-one American, seventeen West-Indian, fifteen Spanish, nine British, two French, two Swedish, and one Portuguese, were wrecked here; and this is attributed, chiefly, to the insensible operation of the currents, as will be shown hereafter.

It is singular that, in a chart of the Virgin Islands, published as a survey by Mr. Lockwood, in 1811, the N.W. end of Anegada is laid down as high as $18^{\circ} 57'$ N. The Spanish surveyors assigned to the S.E. end of the island $18^{\circ} 44'$ N. and $64^{\circ} 17'$ W. It is to be regretted that M. Schomburgk has given no detail of his survey, and this leaves a suspicion that Anegada, &c. may really lie more to the North and West than he has represented; for we must take into account the relative situation of Virgin-gorda, St. Thomas's, &c.

Pajaro, or the N.E. point of Virgin-gorda, was given by the late Admiral Lövenorn as in longitude $64^{\circ} 25'$ W. This is wrong. We have given it after the Spanish officers, in $64^{\circ} 21' 30''$. M. Schomburgk gives it in $18^{\circ} 30' 0''$ N., and $64^{\circ} 14' 40''$ W.

6. ST. THOMAS'S.—With the position of Fort Christian, as given in the Table, from a Danish Survey, compare the communication of Capt. J. W. Monteath, *Colombian Navigator*, Vol. III. Note 3, page xx. But it has been stated that *Cowell's Battery*, which is nearly on the meridian of Fort Christian, lies N. $21^{\circ} 54' 27''$ W. (true), $37\frac{3}{4}$ miles, from the Lang Observatory in St. Croix, which gives the position of its flag-staff in latitude $18^{\circ} 19' 32''$, longitude $64^{\circ} 55' 45''$ only.

7. ST. CROIX.—Fully nine nautic miles from the eastern extremity, N.E. by E. $\frac{1}{2}$ E. (true), and about 11 miles E. by N. from the east point of Buck Island, commences the eastern extremity of an extensive bank or shoal, the northern limit of which rounds off from thence to the N.W., and soon after stretches westerly, inclining to the south of a westerly direction toward Buck Island shoals and reefs, with which it may be considered as connected. The northern edge of the shoal is a coral ledge, several miles in extent, on which $5\frac{1}{2}$ fathoms of water is the least depth yet found; the more common depths being 6, $6\frac{1}{2}$, and 7 fathoms. The sea has been observed to break on the whole line of the northern edge, and to the very extremity of the bank, in an alarming manner, during a northerly grown swell in the winter months.

8. OBSERVATORY OF SIR ANDR. LANG.—“The height of the observatory above the sea is 440 English feet. The latitude is true to within one second. The longitude is the result,

result, I may say, of the labour of years, and the present assumption of $64^{\circ} 41' 0''$ in arc, or 4 h. 18 m. 44 s. in time, West from Greenwich, I consider to be determined with almost such absolute certainty, that I do not think the error in the determination can exceed four seconds in time, or one minute in arc, and I trust is less. On that datum the longitudes of the other stations are accurately determined. All the latitudes are certain to one or two seconds."—*Andr. Lang.*

[From the observatory communication by signal, according to Capt. Marryat's code, will be attended to. The observatory is situated about two miles to the E.S.E. of the town of Christianstæd. In clear weather the shoals are distinctly seen.—E. D.]

9. CHRISTIANSTÆD.—Nearly one mile due north from the entrance of the harbour of Christianstæd is the western extremity of a reef, called the Scotch Reef, which stretches from thence, with its shoals, fully one mile and a half to the E.N.E., rendering the approach to the harbour very dangerous to strangers.

10. SALT RIVER.—Salt River Point is comparatively a low point, and one of the most northerly in the island. About one-fourth of a mile to the north of it is a dangerous sunken rock, called the White Horse, on which the sea generally breaks.

11. HAMS BLUFF, along its northern part, is bold-to.

12. FREDERICKSTÆD, or *West-end Bay*, is an extensive and beautiful bay, affording excellent and smooth anchorage, except when the wind has westing; but like all anchorages of that open kind, it then becomes dangerous.

13. SANDY POINT.—To the south of this low and deceiving point, at nearly a mile, there extends a dangerous reef, to which a good berth should always be given.

14. BUCK ISLAND.—This island, except on its southern side, is surrounded with dangerous reefs and shoals, extending fully one mile to the W.N.W. of the N.W. point of the island; fully two miles to the eastward of its eastern extremity, and about one mile to the north of the island; forming, in the intervening bearings, a circuitous connection of the greatest dangers, which all prudent persons will avoid approaching.

15. *A Royal Ordinance*, dated Copenhagen, 6th June, 1833, declared St. Croix a free port; and all vessels, without exception, Danish or Foreign, may have free admittance, and may discharge or load cargoes in the port of Christianstæd or that of Frederickstad.

Of goods imported, the following are admitted free of duty. Corn-meal, Indian corn, rum-puncheons, staves, heading and hoops for sugar-hogsheads and rum-puncheons; copper nails, hoes, bills, utensils for boiling sugar and distilling rum, fire-bricks, mules and asses: provision and fresh fruits, such as yams, cassava, bananas, oranges, &c. brought from foreign West-India Islands; West-India colonial produce, with the exception of coffee and tobacco, on which duty will be required.

VARIATIONS OF THE COMPASS.—From the S.W. end of St. Domingo, where the variation is 5° E., it diminishes to the eastward; and it has lately been found, in the Mona Passage, and about the Virgin Islands, to be from three degrees to one degree East. At St. Croix, in 1832, $1\frac{1}{2}^{\circ}$ E. At Anegada, only $0^{\circ} 30'$ E.

18. The CARIBBEE and LEEWARD ISLANDS.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
CARIBBEE ISLANDS. [1.]							
Sombrero [2.]..	18	38	0	63	29	30	The observations of the Spanish Officers, &c. rectified as already explained.
Dog Isle: the centre	18	18	25	63	27	30	
Anguilla Kay	18	8	0	63	11	45	
St. MARTIN's; Philipsburg ..	18	1	15	63	7	0	
— West point	18	2	50	63	10	0	

CARIBBEE AND LEEWARD ISLANDS, CONTINUED.

	LATIT. N.	LONG. W.	AUTHORITIES.
Saba; the middle	17 39 20	63 19 0	The observations of the Spanish officers, &c. as already explained.
St. Bartholomew; East Point..	17 53 0	62 52 0	
St. Eustatius; the Road [3.]..	17 29 30	63 4 30	
St. CHRISTOPHER'S; Basse-Terre	17 19 30	62 49 30	The Chart of the Islands and Channels of St. Bartholomew, St. Martin, Anguilla, Dog and Prickly Pear, &c., by Mr. S. Fahlberg, lately published by Mr. Laurie, exhibits different points, as follow : Dog Island (<i>Middle</i>)..... 18 18 25 N. 63 27 30 W. Great Anguilla Kay 18 8 0 — 63 11 45 — Anguilla, East Point 18 17 35 — 62 56 45 — St. Martin's, West Point .. 18 2 50 — 63 9 50 — Hat I. (N.E. of St. Martin) 18 5 30 — 63 1 0 — St. Bartholomew (N.E. Pt.) 17 52 40 — 62 53 35 — Gustavia.. 17 51 0 — 62 57 40 —
Nevis; Charlestown....[5.]..	17 10 0	62 42 0	
Redonda; the pinnacle	16 55 30	63 26 0	
Montserrat; N.E. point	16 48 0	62 16 20	
Antigua; St. John's Road [6.]	17 9 40	61 57 0	
Desirade or Deseada; N.E. Point	16 20 0	61 6 30	
GUADALOUPE; Basse-Terre [8.]	15 59 30	61 47 30	
Marie-galante; Basse-Terre ..	15 52 0	61 22 0	
The Saintes; Western, S.W. Point	15 51 20	61 44 0	
Dominica; Road of Roseau [9.]	15 18 30	61 28 0	
MARTINIQUE; Fort Royal [10.]	14 36 7	61 7 25	
St. Lucia; Pt. Moulacique or South Point	13 35 0	61 1 0	
St. Vincent; Kingston	13 9 0	61 15 0	
BARBADOES; Bridgetown [11.]	13 5 30	59 41 40	
Granada; Fort St. George [12.]	12 2 54	61 48 30	
Tobago; N.E. Point	11 20 13	60 33 30	
S.W. End ..[13.]..	11 7 35	60 52 30	
TRINIDAD; [14.]			The admirable Survey of the Coasts of Venezuela, &c., by Don Joaquin Francisco Fidalgo, and other Spanish officers. Published, by the ' <i>Direccion Hidrografico</i> ,' at Madrid, in 1816 and 1817. BUEN-AYRE or BONAIRE. A tower, painted white, with vertical red stripes, on the southern point of Buen-ayre, now exhibits a brilliant fixed light, at 70 feet above the level of the sea, which may be seen, in clear weather, four leagues off. Lat. 12° 2' 30", long. 68° 21' 20".
Point Galera, the N.E. Point	10 50 20	60 56 35	
Point Galeota, the S.E. Point	10 9 30	61 0 50	
Boca de Navios, or Ship Channel	10 41 45	61 48 0	
PORT SPAIN	10 38 42	61 34 15	
Testigos; centre	11 23 15	63 10 50	
MARGARITA :			
Pampatar	10 59 15	63 53 30	
North Point	11 10 30	63 58 30	
Pta. de Arenas, or Sandy Pt.	10 59 0	64 29 30	
Blanquilla; North Point	11 54 30	64 41 50	
Tortuga; East Point	10 54 45	65 16 50	
Orchilla; N.E. Breakers	11 52 45	66 9 30	
Shoal of Two Fathoms	12 9 15	66 9 20	
Los Roques or Roccas;			
N.E. Islet.....	11 58 40	66 42 20	
Islas de Aves; (<i>Birds' Is.</i>)			
Windward Isle	11 57 30	67 31 20	
Leeward Isle	11 59 30	67 45 35	
Buen-ayre; N.E. Point	12 14 0	68 18 30	
CURAZAO; North Point	12 24 0	69 16 20	
Bay of St. Anne; Entrance ..	12 6 20	69 3 0	
Little Curazao; North End ..	12 0 0	68 44 30	
Oruba; the S.E. Point	12 23 45	70 0 0	

It is clear that these islands are very incorrectly delineated in the Spanish chart.

NOTES.

1. WINDWARD and LEEWARD ISLANDS.—Under the denomination of *Windward Islands*, the navigators of France and Spain include the whole range from the Virgins to Trinidad; and, under that of *Leeward Islands*, the range which exists between Trinidad and the Gulf of Maracaybo. This distinction is natural and proper, and we have adopted it, in preference to the former distinction in the English charts, which includes, under the name of *Leeward Islands*, those from Porto-Rico to Dominica only; and, under that of *Windward Islands*, those from Martinique to Tobago.

The observations of the Spanish officers for determining the respective situations of the Caribbee Islands, have been very numerous and important, and our late charts have been regulated chiefly thereby. Some later corrections have, however, been made, particularly in the northern part of the range, and in the Virgin Isles. See the Notes 5, 6, 7, and 8, pages 69, 70.

2. SOMBRERO.—This solitary islet is a flat and rocky eminence, $2\frac{1}{4}$ miles in length, N.N.E. and S.S.W., without any hummock, having neither quadruped nor vegetable upon it, excepting grass, and that generally dry, with a few weeds, &c. It is even destitute of water. See '*Colombian Navigator*,' Vol. III., page 64.

3. EUSTATIUS.—The latitude of the road, according to observations made at sea, in the frigate *La Flore*, by Messrs. Verdun, &c., is $17^{\circ} 29'$, and the longitude $63^{\circ} 2'$. The position given in the Table has been corroborated by Captain Monteath: "1820, 15th Nov. in latitude $17^{\circ} 23'$; longitude of the East point of Eustatius, by chronometer, $63^{\circ} 2' 15''$; by lunar observations, $63^{\circ} 7' 8''$; mean, $63^{\circ} 4' 41''$."

4. ST. CHRISTOPHER'S.—In January, 1782, the Marquis de Chabert took nine meridian altitudes, whence he concluded the latitude as in the Table. The longitude, by his marine clocks, previously examined at Martinique, appeared as $62^{\circ} 52' 30''$.

5. NEVIS.—The latitude, from the observations of Captain Monteath, appeared to be as follows: "1820, Nov. 15. In 17 fathoms of water upon the bank on the south side of Nevis, Charlestown bearing north, distant about three miles, I observed the latitude to be $17^{\circ} 3' 30''$; adding $3'$ on the bearing of Charlestown, gives $17^{\circ} 6' 30''$; the existing Tables gave $17^{\circ} 10' 30''$: but this, I am confident, is too far to the north."

6. ANTIGUA.—East point of Green Isle. 1820, 14th Nov. as seen from lat. $16^{\circ} 55'$. Three observations by Captain Monteath: the chronometer gave $61^{\circ} 39' 23''$: lunars, $61^{\circ} 44' 16''$: mean, $61^{\circ} 41' 50''$.

7. DESIRADE.—From observations made by the Chev. de Borda, he computed the lat. of the N.E. Point as $16^{\circ} 20' 30''$.

Captain Monteath, in latitude $16^{\circ} 58'$, by three observations. Longitude of a ship by chronometer, $61^{\circ} 9' 45''$; by lunars, $61^{\circ} 14' 38''$; mean, $61^{\circ} 12' 12''$. Bearing of Desirade, S. 5° E. distance 36 miles, which gives $3'$ of departure, $= \times$ longitude $3' 5''$. Hence, longitude of the centre of Desirade, $61^{\circ} 9' 7''$.

8. GUADALOUPE.—The latitude of Basse-terre has been confirmed from the observations of M. de Verdun, &c. The longitude (assuming Fort Royal, Martinique, as in $61^{\circ} 9'$) appeared to be $61^{\circ} 48' 15''$. M. Tondou, in 1783, concluded the longitude, by three immersions and two emersions of the first satellite of Jupiter, to be $61^{\circ} 48'$. The latitude of Pointe des Chateaux, the eastern point, was observed by M. de Borda, as $16^{\circ} 12' 30''$.

9.—ROSEAU.—The latitude of this place, according to the result of observations by Messrs. Verdun, &c., is $15^{\circ} 18' 23''$. But the French officers have given the longitude $7\frac{1}{2}$ minutes to the westward of that shown in the Table, which cannot be correct.

10. MARTINIQUE.—The latitude accords with that resulting from the observations of Messrs. Verdun, Borda, &c., who concluded the longitude as $61^{\circ} 9'$, or only $1' 35''$ more than that now given in the Table. Mr. Dunsterville gives the longitude of the Diamond Rock as $61^{\circ} 6'$.

In the Survey of Martinique, executed by order of the French government in 1824 and 1825, as shown in the third volume of the *Colombian Navigator*, the longitude of the flag-staff of Fort St. Louis, on which all the other longitudes depend, appears to be six minutes to the eastward of the longitude which we have assumed. See Note 10, in that volume,

page xxi., and the Table in page 91; which may be compared with the notes hereto annexed.

11. BARBADOES.—The late Dr. Nevil Maskelyne communicated the latitude of St. Michael's church, in Bridge-town, as $13^{\circ} 5' 30''$. The longitude has since been given as $59^{\circ} 43' 40''$ and $59^{\circ} 41' 15''$; the present longitude is given as $59^{\circ} 41' 40''$.

12. GRANADA.—In 1779, M. de Chabert concluded the latitude of Fort St. George as $12^{\circ} 2' 54''$, and its longitude $42\frac{1}{2}$ minutes west of Fort Royal, Martinique. This varies only 20 seconds from the statement in the Table. Captain G. Daniell, of H.M.S. *Victor*, in 1833, made the longitude $61^{\circ} 48' 30''$.

13. TOBAGO.—M. de Chabert, 1781, made the longitude of the S.W. Point $20'$ to the east of Fort Royal, Martinique: this places the point in only $60^{\circ} 47\frac{1}{2}'$ W. The position formerly given in the *Connaissance des Temps*, was $11^{\circ} 6' \text{ N.}$ and $60^{\circ} 49' \text{ W.}$ The Baron Alex. de Humboldt, in his '*Personal Narrative*,' (Engl. Transl.) gives it as $10^{\circ} 20' 13'' \text{ N.}$ and $60^{\circ} 27' 30'' \text{ W.}$ The latter is evidently a great error, as it would place Tobago directly east of the body of Trinidad. We presume that the N.E. end was intended: and that in $11^{\circ} 20' 13'' \text{ N.}$, not $11^{\circ} 10' 13''$, as since in the *Connaissance des Temps*. But if, upon conjecture, we take M. Humboldt's longitude thus, we shall place Tobago too far to the east: for it is allowed that the situation of Trinidad has been settled by the Spanish surveyors, and it is well known that the high land of Trinidad is seen from the ships at anchor in Courland Bay, over the land of Sandy Point, which could not be the case if the former authorities were correct. See the New Chart of the Coasts, &c., from Tobago to Barcelona, lately published by Mr. Laurie. Captain Daniell, in H.M.S. *Victor*, 1833, made the longitude of Great Courland Bay $60^{\circ} 51' 15''$.

14. PORT-SPAIN IN TRINIDAD.—Captain Edw. Sabine, R. Art., has, from a great number of observations, given the position of the Protestant church in Port-Spain as $10^{\circ} 38' 56'' \text{ N.}$ and $61^{\circ} 35' 0'' \text{ W.}$; but we have generally found Captain Sabine's longitudes rather too far to the west. This new and beautiful church is said by Capt. S. to be one of the many improvements and decorations for which Port-Spain is indebted to its late governor Sir Ralph Woodford, and which have rendered it one of the handsomest towns in the British colonies. The town is built on a bed of gravel, between 30 and 40 feet deep, resting on a substratum of clay. The society is agreeable, and there are many natural beauties and curiosities in the island. The meridian of the Protestant church divides the town into nearly two equal parts: See, further, *Colombian Navigator*, Vol. III. page 118.

VARIATION OF THE COMPASS.—In the channel between Porto-Rico and the Virgin Islands, the variation is about 3 degrees east: but on the east of Anegada, it diminishes to $0^{\circ} 30'$ east. At Antigua and Guadaloupe it is 2° east; and nearly the same thence to Granada. At Barbadoes, only 2° ; but at Trinidad, $2^{\circ} 55' \text{ E.}$

19. THE COASTS OF GUYANA, COLOMBIA, &c. to the MEXICAN SEA, inclusive.

	LATIT. N.	LONG. W.	AUTHORITIES.
CAPE NORTH.....[1.]..	$1^{\circ} 51' 0''$	$49^{\circ} 50' 0''$	M. de la Condamine and the French Engineers; including Lieut. Romain Desfossés, who surveyed the 'Iles du Salut,' in 1834.
Mount Mayez, a landmark....	$3^{\circ} 5' 0''$	$50^{\circ} 55' 0''$	
Cape Orange.....[2.]..	$4^{\circ} 10' 0''$	$51^{\circ} 15' 0''$	
St. Luis of Oyapok; fort....	$3^{\circ} 57' 0''$	$51^{\circ} 27' 0''$	
CAYENNE.....[3.]..	$4^{\circ} 56' 15''$	$52^{\circ} 16' 30''$	The Observations of Lieut. Bischoep Greevelink, late of the Netherlandish Navy, in the brig <i>Echo</i> , 1833, 4, 5, 6, 7.
Iles du Salut; I. Royale [4.]..	$5^{\circ} 16' 10''$	$52^{\circ} 32' 8''$	
River Marowyne; Dutch post.	$5^{\circ} 56' 0''$	$53^{\circ} 58' 20''$	
Post Orange.....[5.]..	$6^{\circ} 1' 0''$	$54^{\circ} 36' 0''$	
Mot Creek.....[6.]..	$6^{\circ} 1' 30''$	$54^{\circ} 40' 41''$	
Cameron's Plantation ..[5.]..	$5^{\circ} 55' 30''$	$54^{\circ} 59' 0''$	
Bram's Point, Surinam..[6.]..	$5^{\circ} 56' 20''$	$55^{\circ} 12' 48''$	
PARAMARIBO; the church....	$4^{\circ} 43' 30''$	$55^{\circ} 13' 30''$	

THE COASTS OF COLOMBIA, &c. CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
River Corentyn; Nickerie							The topographical Surveys, adjusted by the longitude of Demerary, as given by Capt. Owen, &c.
Battery, on the East ..[7.]..	6	9	30	56	52	30	
Mary's Hope, on the West..	6	14	30	57	2	0	
Berbice; Crab Isle.....	6	24	30	57	22	0	
Corobana Point, Demerary; the Lighthouse.....[8.]..	6	49	20	58	11	30	Lat. 'Derrotero de las Antillas;' Long. inferred by chart.
River Essequibo; extremity of the Leguan Bank.....	7	0	20	58	18	0	
Boca de Guayma	8	25	0	59	52	0	
RIVER ORINOCO: [9.]							Don Cosmé de Churruca and the Baron Alex. de Humboldt.
Punta or Point Barima	8	44	30	60	3	0	
Isle Cangrejos; N.E. Point.	8	51	0	60	22	0	
TRINIDAD. See the preceding Section, page 81.							
Cape Three Points....[10.]..	10	45	15	62	45	50	The Spanish Surveys of the Coasts of Venezuela, &c. by Don Joaquin Francisco Fidalgo, and other Spanish officers. Published by the <i>Direccion Hidrografico</i> , at Madrid, in 1816 and 1817.
Cape Malapasqua	10	42	50	63	6	35	
CUMANA, the City of ..[11.]..	10	27	37	64	15	15	
Puerto de Mochima; Entrance	10	24	0	64	26	30	
Isla Borracha; N.E. Point....	10	19	40	64	49	15	
BARCELONA; MOIRO of	10	13	15	64	48	20	
Piritu Isles; Centre.....	10	9	0	65	1	35	
Isle Unare; Centre	10	5	15	65	21	0	
Cape Codera	10	35	54	66	11	30	
Chuspa; the Point	10	39	30	66	25	35	
La Guayra; the Road.....	10	37	0	67	1	35	
City of CARACAS (<i>St. Iago de Leon</i>)	10	30	0	67	0	55	
Puerto de Turiamo	10	29	10	67	57	20	
PUERTO CABELLO; Entrance..	10	29	45	68	7	35	
Punta Tucacas; South Kay ..	10	43	0	68	20	5	
Punta de S. Juan	11	9	0	68	31	35	
Punta del Ubero	11	19	30	68	49	15	
Punta del Manzanillo	11	31	15	69	24	5	
Vela de Coro	11	26	30	69	42	5	
CAPE S. ROMAN	12	11	0	70	8	35	The whole of the Colombian coast, from the island of Trinidad to Chagre, has been so finely and accurately surveyed, by Don Joaquin Fidalgo, and other Spanish officers, as to leave nothing more to wish for, so far as the survey extends; the south side of the <i>Gulf of Venezuela</i> only excepted.
Punta de la Macolla	12	5	0	70	21	20	
Santa Anna de Coro	11	24	0	69	49	50	
Fort or Castle of Zapara.....	10	58	30	71	41	30	
MARACAYBO; Town	10	39	0	71	45	0	
Punta de Espada	12	4	0	71	11	50	
Bahia Honda; Entrance	12	20	0	71	50	35	
CAPE LA VELA	12	11	0	72	15	35	
Rio de la Hacha; Town	11	33	30	72	58	55	
Cape S. Augustin	11	16	0	73	40	5	
Cape S. Juan de Guia.....	11	20	45	74	4	20	
Cape de la Aguja.....	11	18	30	74	16	20	
SANTA MARTA	11	15	0	74	17	35	
Rio Magdalena:							
Boca de Rio Viejo	11	5	0	74	47	35	
Boca de Ceniza	11	5	20	74	56	20	
Pueblo de Barranquillas....	10	59	0	74	51	2	
Punta de Savanilla	11	2	0	75	3	0	

THE COASTS OF COLOMBIA, &c. CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	'	"	°	'	"	
Morro Hermosa*	10	58	0	75	4	45	<p>REMARKS.</p> <p>* The MORRO HERMOSA, in lat. 10° 58', is a hill which constitutes a useful landfall westward of the Magdalena, and is noticed as such in the <i>Colombian Navigator</i>, Vol. III.</p> <p>There is said to be a rock, at 5½ miles to the W.S.W. from the Morro, in long. 75° 10', and at about 3½ miles from the nearest land, not laid down on the Spanish chart. It has 6 fathoms of water around it, with only 11 feet on its centre. The <i>Cascabel</i> or <i>Cascavel</i> lies within it, off the Rio Caimanes, at only half a league from shore, and cannot, therefore, be the same.</p> <p>** The coast between Chagre and the River Tortuga has not yet been surveyed: the positions are, therefore, to be considered as an approximation only.</p> <p>The Observations and Surveys of Captain Richard Owen, in H.M.S. <i>Blossom</i> and <i>Thunder</i>, between 1828 and 1837.</p> <p>REMARKS.</p> <p>The whole of the coasts of the Bay of Honduras, from Cape Gracias a Dios to Cape Catoche, including the isles and shoals between the Pedro Bank and Costarrica, have been surveyed under the able direction of <i>Captain Owen</i>; Lieut., now Captain, <i>Bird Allen</i>; Lieut., now Captain, <i>Edw. Barnett</i>; Lieut. <i>Jas. Cannon</i>, and other skilful officers of the British navy. These important surveys have been the mean of correcting enormous errors in the representation of the Gulf of Honduras, and they have also given, for the first time, a true representation of the Rio and Golfo Dulcé, the</p>
Cascabel Rock	10	55	10	75	7	45	
Palmarito Shoal	10	51	45	75	19	0	
Punta de la Galera	10	47	0	75	29	5	
Punta de Canoas	10	34	15	75	35	50	
CARTAGENA; Popa [13.]	10	26	0	75	37	5	
Salmedina Bank (2 fms.)	10	23	0	75	44	35	
Boca Chica; Entrance	10	19	30	75	40	7	
Islas del Rosario; larger I.	10	11	0	75	49	35	
Islas de S. Bernardo; Tintipan or North I.	9	48	0	75	55	20	
Santiago de Tolu	9	30	45	75	39	50	
Puerto de Cispata; Entrance	9	25	0	75	51	55	
Isla Fuerte	9	23	30	76	15	5	
Punta Arenas; Entrance of G. of Darien	8	33	0	77	0	5	
Cape Tiburon	8	41	15	77	26	35	
Puerto Carreto	8	47	15	77	38	35	
Isla de Pinos; N. Point of	9	1	30	77	49	50	
Cayo Ratones	9	23	0	78	20	5	
Punta S. Blas; E. Point	9	34	36	79	1	30	
Punta del Manzanillo	9	39	30	79	36	50	
PUERTO VELO, or Porto-Bello; the Town	9	24	29	79	43	40	
Punta del Toro	9	23	45	80	1	20	
CHAGRE; the Town	9	21	0	80	4	5	
Escudo or Shield of Veragua; centre	9	11	0	81	16	0?	
Boca del Toro; entrance	9	26	0	82	36	0?	
Boca del Drago; entrance	9	32	0	82	55	0?	
River Tortuga; entrance	10	35	0	83	31	0	
S. JUAN de Nicaragua, or del Norte; Sandy Point	10	56	45	83	42	0	
ISLANDS, &c. in the BAY of GUATÉMALA:							
Serranas; S.W. kay	14	19	0	80	22	0	
Quita Sueno; S.E. point	14	7	30	81	8	0	
Roncador Kay, on N.W. reef	13	34	30	80	5	15	
Providence Island; Sta. Catalina	13	23	0	81	22	30	
St. Andrew's; Centre	12	35	0	81	43	0	
Courtown or E.S.E. Kays	12	24	15	81	28	0	
Albuquerque or S.S.W. Kays	12	10	0	81	51	0	
MOSQUITIA or MOSQUITO SHORE:							
Blewfield Bluff	11	19	20	83	40	18	
Punta Gorda	11	28	0	83	47	0	
Parrot Isle (135 feet high)	11	30	38	83	42	30	
Man of War Kay; N.E. Kay	13	1	0	82	58	50	
Bragman Bluff; N. part	14	3	0	83	31	40	
Mosquito Kays; S.E. Kay	14	21	15	82	45	50	
CAPE GRACIAS A DIOS [18.]	14	59	30	83	12	0	
Carataska Lagoon; Entrance	15	23	40	83	43	0	
Point Patook	15	49	15	84	18	0	

COLOMBIA, HONDURAS, &c. CONTINUED.

	LATIT. N.			LONG. W.			AUTHORITIES.
	°	′	″	°	′	″	
Poyas Peak (3500 feet high) ..	15	46	0	84	53	30	the coasts of which were never before explored. (<i>Colombian Navigator</i> , vol. III., page xxiv.)
Cape Camaron; E. extremity ..	16	0	30	85	2	40	
Cape Honduras	16	1	30	85	59	30	
Bonacca; N.E. extremity	16	30	0	85	47	37	The longitude of Bonacca, formerly misprinted, by mistake in copying, should stand as annexed.
Ruatan; Port Royal	16	23	45	86	19	0	
Utila; highest hill (295 feet) ..	16	7	45	86	53	30	
Swan Islands; East point	17	24	30	83	52	50	
Misteriosa Bank; N.E. part ..	18	56	15	83	41	38	
THE COAST continued:							
Peak of Congrehoy (7500 feet high).....	15	38	55	86	54	0	The Observations and Survey of Captain Richard Owen, &c., between 1828 and 1837.
Cape Triumfo; the point	15	48	45	87	27	56	
Omoa; low west point	15	47	10	88	4	40	
CAPE THREE POINTS; extremity	15	57	45	88	38	50	
Rio Dulcé; entrance ..[19]..	15	49	45	88	46	32	
Point Iacos.....	16	14	15	88	35	54	
Point Placentia	16	30	53	88	22	30	
Colson's Point; N.E. extremity	17	4	15	88	15	0	
BALIZE; the fort islet	17	29	20	88	11	30	
OUTER KAYS AND REEFS:							
Glover's Reef; N.E. extremity	16	55	0	87	43	50	
S.W. Kay	16	42	20	87	50	57	
Half-moon Kay; Lighthouse [20.]	17	12	11	87	32	24	
North Kay on Lighthouse Reef	17	28	20	87	27	0	
Turneff; Kay Bokel ....[21.]	17	8	30	88	55	58	
Mauger Kay	17	36	15	87	46	40	
Rendezvous Kay.....	17	15	0	88	0	45	
English Kay; flag-staff	17	19	25	88	0	20	
Goff's Kay	17	20	55	87	59	15	
St. George's Kay; anchorage [23.]	17	33	15	88	4	54	
Northern Triangle; South end.	18	23	30	87	23	0	
North Kay [24.]	18	45	0	87	19	0	
Shamrock Bay; S.E. pt.....	19	17	30	87	28	0	
Ascension Bay; South point ..	19	36	15	87	25	15	
Kilbride Cliffs; stone buildings	20	11	45	87	25	50	
Cosumel; South point [25.]..	20	16	0	86	59	39	
N.E. point	20	35	30	86	44	34	
Mugere Isle; South point	21	12	15	86	43	15	
Punta Brava	21	0	0	86	44	0	
Cape Catoche	21	33	0	86	59	40	
Monte Notepederas ..[27.]..	21	10	0	90	5	30	
CAMPECHE; Town....[28.]..	19	51	10	90	28	15	
Javinal Point	19	12	0	90	53	0	
Punta de Xicalango	18	41	0	91	50	0	
Barra de S. Pedro	18	40	0	92	25	0	
Barra de Tabasco	18	34	30	92	35	0	
Barra de Chiltepeque	18	26	30	92	59	0	
Rio Tupilco, Entrance of	18	26	0	93	21	0	
Barra de Gozacoalca.....	18	10	0	94	17	0	
La Barilla	18	10	0	94	30	0	
Punta de S. Juan	18	18	0	94	33	0	

The Spanish Surveys of the Mexican Sea, 1808-1814, with emendations by Admiral Mackellar, of the British Navy, and by the Baron Alex. de Humboldt, &c.

HONDURAS, &c. CONTINUED.

	LATIT. N.	LONG. W.	AUTHORITIES.
Roca Partida, or <i>Cleft Rock</i> ..	18° 43' 0"	95° 2' 0"	The Spanish Surveys of the Mexican Sea, 1808-1814, with emendations by Admiral Mackellar, of the British Navy, and by the Baron Alex. de Humboldt, &c.
BARRA de ALVARADO .[29.]..	18 45 0	95 42 0	
VERA CRUZ; the <i>Light-house</i> .....[30.]..	19 12 15	96 7 12	
Xalapa.....	19 30 8	96 55 0	
Cofre de Perote .....[31.]..	19 32 54	97 8 0	
Peak of Orizaba or Orizava ...	19 2 17	97 12 15	
Puebla de los Angeles.....	19 0 15	98 2 45	
Toluca	19 16 19	99 21 45	
Tescuco	19 30 40	98 51 15	
MEXICO .....[32.]..	19 25 45	99 5 30	
Cape Roxo	21 36 0	97 18 0	The RIO BRAVO del NORTE is the western boundary of the territory claimed by the new government of TEXAS.
BARRA de TAMPICO ..[33.]..	22 15 56	97 50 18	
Barra de Santander.....	23 46 0	98 2 0	
Boquillas Cerradas	25 0 0	97 45 0	
Rio Bravo del Norte; Entr. ..	25 55 0	97 24 0	

NOTES.

1. CAPE NORTH to CAPE ORANGE.—Between the *Cabo del Norte*, or Cape North, and Cape Orange the land is very low and marshy, with some thick woods, and soundings reach out a great way to sea. In the clearest day it is not possible to discern the land when five leagues off. The only mark is the hill called *Mount Mayez*, situate near the position given in the Table.

2. CAPE ORANGE may be known by a point which seems to have been cut down or shortened on the side next the sea, and is the highest land to the S.E. of the Cape; and also by the *Silver Mountains*, which form various peaks, appearing insulated or detached the one from the other, and which are the more remarkable, as they are the first high land discovered in coming from Cape North.—*Colombian Navigator*, Vol. III. p. 153.

3. CAYENNE.—The situation of this town was given by M. la Condamine, in 1774, from four eclipses of the first satellite of Jupiter, as in the Table. The town and fortress are situate on the N.W. point of the island, the north part of which has various hills and eminences, close to the coast, but the south part is low, and wet in the season of the rains.

4. ISLES du SALUT, or Islets of Health.—These were formerly called the *Devil's Islets*, but they form a fine and well-sheltered harbour. The best anchorage is with the southern islet *St. Joseph*, E.S.E. in 5 or 6 fathoms, hard bottom, at about a musket shot from shore.—*Colombian Navigator*, Vol. III. p. 155. ('E.S.E. of the southerly islet' should be corrected as above.)

5. COAST between the MAROWYNE and BRAM'S POINT.—To Lieut. B. Greevelink, late of the Netherlandish navy, the public is indebted for that valuable description of the coasts of Guyana and its several ports, which is included in the third volume of the *Colombian Navigator*. The following are extracts from the same, on the coast between the Marowyne and Bram's Point.

"The coast between the Marowyne and Surinam Rivers lies still uncultivated, with the only exception of *Mr. Cameron's plantation*, noticed beneath; and nothing but thick wood, of an almost uninterrupted uniformity, presents itself to the view, without the smallest emerging object. In making *Post Orange*, which is in longitude 54° 36', you will see the Dutch flag hoisted there, and a few houses, of a dark brown aspect, lying nearly hidden in the forest. This post lies nearly 13 leagues to the westward of the Marowyne, and at about the same distance from Bram's Point.

It ought to be remarked that, although in former times there may have existed some like-
ness

ness between Post Orange and Bram's Point, at present none such is to be found; the large tree at Post Orange, mentioned in former descriptions, is probably fallen or dead, and the flag only may serve to distinguish the spot. At Bram's Point, however, no flag is now to be seen. At about five miles to the west of Post Orange is the *Mot-Kreek*, (Mot Creek,) where also the Dutch flag is displayed, as a mark for ships; a few houses, in a similar manner, lie scattered among the trees.

The next mark you have (for you must be very attentive in keeping a good look-out), is a break in the land, through which appear the houses and buildings of a plantation, called *Cameron's Castle*. The mansion, a large structure, painted white, has a steeple or tower upon its roof, which makes it the best mark on this part of the coast.

6. *SURINAM RIVER*.—In 1817 a beacon was erected on Bram's Point, but since 1832 it has broken down, together with the houses, flag-staffs, and every other object previously existing; so that, at present, not the smallest trace of human habitation is to be seen there: but two iron vessels with masts, and two copper buoys, have been laid down, as a guide to the river.—*Col. Nav.* Vol. III. p. 135.

7. *THE CORENTYN*.—Between the Surinam and the Corentyn, an extent of about 30 leagues, the shore is generally low, flat, and sandy, and the whole of it is bordered by a mud bank, which is, in some places, not less than five miles broad. The Corentyn has been described by M. Schomburgk, as shown in our former work, but we may here repeat the remark, that, judging from the difference of latitude between Demerary lighthouse (in $6^{\circ} 49' 20''$), and Mary's Hope, as given on the best existing maps and charts, we have already expressed our apprehension that Mr. Schomburgk's latitudes are about 12 minutes too far south; an impression which we still retain. As the error, *if such*, is a very dangerous one, it requires the more particular notice.

8. *DEMERARY*.—On making the coast about Demerary as on that to the eastward, similar precautions must be taken. The land, however, about this river is the most remarkable of any part of the coast; the woods in many places being burnt down, and cleared for cultivation, makes the land appear in large gaps, where the houses, &c. are plainly to be seen; and if there are any ships lying at the lower part of the river their mast-heads may be plainly seen above the trees, from some distance at sea.

The river is half a league wide at the entrance, but obstructed by a bar of 9 to 11 feet at low, and 18 or 19 at high, water. *George Town*, on the east bank of the river, is a mile and a half from the fort, defending the entrance.

The *Lighthouse* upon Corobana Point, on the eastern side exhibits a bright fixed light, which may be seen at four leagues off; but those approaching should be cautious that another light on shore may not be mistaken for the lighthouse. The navigation has also been facilitated by a light-vessel, which was placed off the entrance in 1838, in the depth of $3\frac{1}{2}$ fathoms at low water, which likewise exhibits a fixed light. From the light-vessel the lighthouse on shore bears S.W. by S. 12 miles distant. Vessels inward bound engage pilots from the floating light, upon heaving to for that purpose.—*Col. Nav.* Vol. III., pp. 133, 141, 146.

If it be required to beat to windward on this coast, or to proceed from the Orinoco, Essequibo, or Surinam, to Cayenne, it is necessary to work along the coast with the ebb-tide, in from $3\frac{1}{2}$ or 4 fathoms of water, outward to 8 or 9 fathoms: for, though you may be shouldered away by the current to the N.E., you will gain very well on the tack to the S.E. or E.S.E.: but, with the flood-tide, you must anchor; for, then, both wind and current being against you, you would inevitably be driven ashore.

Those who, from the Antillas, are bound to any port in Guyana, should keep their larboard tacks on board, until in a convenient latitude to make the land to the southward of the port of destination; this may be more or less to the southward, according to the navigator's experience on the coast. The most experienced have frequently been deceived, and observations for latitude, with every other precaution, should, therefore, be taken.

9. *RIVER ORINOCO*.—For the positions given by M. de Humboldt, &c. see the English translation of his '*Personal Narrative*,' Vol. V. pages 719, 20. Here it may be noticed that no regular survey of the mouth of this river has yet been made, and we have even some reason for believing that the given longitude is to be considered only as an approximation. It should further be understood, that the points Barima and Sabaneta have been confounded with each other. The Punta Barima, or Cape Bremé, of the English and Dutch charts, is the Sabaneta Point of the Spanish: and the Sabaneta Point of our charts is the Punta Barima

Barima of theirs. For the points of the interior, see the '*Colombian Navigator*,' Vol. III., Table, page xi.

10. CAPE THREE POINTS, &c.—From the Bocas del Drago or Great Dragon's Mouth to Cape Three Points, the land is high and hilly, and the coast remarkably clean; so that a ship may run along it, at the distance of half a mile. At a mile from the shore, the depths are from 20 to 40 fathoms, muddy sand.

11. CUMANA.—The castle of S. Antonio, on which the Venezuelan flag is occasionally hoisted, is only 30 toises ($31\frac{3}{4}$ fathoms) above the level of the sea. Placed on a naked and calcareous hill, it, however, commands the town, and forms a very picturesque object to vessels entering the port.

12. CAPE CODERA and PORTS of VENEZUELA.—The principal establishments for commerce on this coast, and toward which vessels from Europe, in general, direct their course, are Cumana, Barcelona, La Guayra, and Porto Cabello; Maracaybo, Santa Marta, and Cartagena; Pampatar, in the island Margarita, and St. Anna in Curazao. It is a general rule on the coast to make the land to windward of the port of destination, in order to prevent falling too far to leeward. Having once entered the Caribbean Sea, it will be proper to make the land about Cape Three Points, or Cape Malapasqua, if bound to Cumana or Barcelona; and those bound to La Guayra will make Cape Codera, &c.

13. CARTAGENA.—The POPA of Cartagena is a remarkable hill, having a monastery on its summit, (*Na. Sa. de la Popa*), which stands at rather more than a mile to the eastward of Cartagena. Of this celebrated town, most of the houses are three stories in height, many of two stories, and a considerable number of only one. The city is commanded completely by the castle of S. Felipe or S. Lazaro, situated on an eminence to the eastward; and this is, in turn, commanded by La Popa. At a short distance to the westward of the monastery is a signal-staff, with a battery, mounting about four guns. When the city bears East, nearly the whole of it is visible from sea. In advancing from the eastward, be extremely cautious on rounding the point of Zamba, as that point is low and dangerous, and there is a shoal off it, but supposed to be correctly laid down in Fidalgo's Survey. Within two miles of Point Canoas is a coral shoal, on which, in October, 1821, H.M. sloop *Nautilus* struck, while running along shore. It had 6 feet of water under the larboard fore-channels, and 4 feet under the starboard gangway. Point Canoas (by comp.) bore N.E. $\frac{1}{4}$ N.; the Popa S. $\frac{1}{2}$ E.; the citadel of St. Lazaro South, distant about $6\frac{1}{2}$ miles.

14. The SERRANAS, *Quita Sueno*, *Roncador*, and *Isle of Providence* (vulgo Old Providence), are described in the *Colombian Navigator*, Vol. III., pages 248, 259. *Roncador* is an islet or kay on the N.W. part of a reef, and elevated about 6 feet above the sea, composed of sand and coral, and having on its S.E. end a few low bushes, on which the man-of-war birds build their nests.

Providence is six miles long from north to south, and three miles broad. Catalina is at its north end, and divided from it by a very narrow channel, over which a bridge formerly existed. These isles were formerly inhabited and fortified by the Buccaneers, and are nearly surrounded by dangerous reefs, of which that to the N.N.E. extends three leagues out, in that direction. Catalina is remarkably rocky; its surface being almost covered with stones. It rises into a mountain, steril and full of inequalities. Providence rises gradually from the sea to an amphitheatre, formed by four hills, crowned by a high mountain. On the cusp or head of the mountain is a spring, which supplies four rivulets running thence in different directions, down to the sea. The water is light and excellent. Both Providence and Catalina, on approaching them, present a delightful variety of beautiful scenery. The hills of Providence vary from 200 to 600 feet in height; but its highest summit, in lat. $13^{\circ} 21' 10''$, long. $81^{\circ} 21' 50''$ is 1190 feet high: its head, as seen from the north-westward, droops toward the east: there is a small peak, close to the westward of it, of 1154 feet. These isles are included in the government of St. Andrews, the residence of the governor.

15. ISLAND of ST. ANDREW.—This island has been recommended as an advantageous spot to those vessels which convey the mails from Jamaica to Chagre; as the sickness, which few of them escape, is occasioned by the long stay which they make for the return mails, being often three weeks at anchor in the roadstead of Chagre. From Chagre the island bears, by compass, N.N.W. $\frac{3}{4}$ W. 214 miles.

On making the island, which may be seen to about seven leagues off, it has the appearance of a high perpendicular hill, declining eastward to a low point; and, on a nearer approach,

approach, the western end of the island appears as if formed by two high sugar-loaf hills connected with each other, while the land eastward is low and uneven. The north point, bearing N.W. appears to terminate in a low perpendicular bluff. The south point is likewise low.

The island is under the national flag of New Granada. It has a military governor, a captain, and twelve soldiers; also two magistrates, annually elected. Here yams, fowls, turkeys, sheep, and bullocks, with fire-wood, may be obtained, but for cash or goods only. Fish is abundant, and fresh water may be obtained. Present population, about 150 whites, who speak English, and 700 negroes. See further, *Colombian Navigator*, Vol. III., pp. 256 and 257.

16. BLEWFIELD BLUFF.—Blewfield Lagoon may be considered as the boundary of the Mosquito country. The bluff, which marks the north side of the entrance, from all directions makes like an island, being connected with the main by a very narrow isthmus. Its height is 150 feet, and breadth from E. to W. about a mile. Cliffs reddish and very bold.

17. BRAGMAN BLUFF.—This bluff affords shelter from north and westerly breezes; it is very conspicuous, being formed of steep red cliffs, 30 or 40 feet high, in latitude $14^{\circ} 3'$. These cliffs occupy an extent of three miles; they cannot be mistaken, as there is nothing resembling them on the coast.

18. CAPE GRACIAS A DIOS.—This point is improperly called a cape, it being a low headland, having trees on it only to the height of 40 or 50 feet, and sloping gradually to the sea. There is a chasm at about 100 yards to the westward of the point, and on approaching from the northward or southward it appears like an islet. Don Josef del Rio, who visited the Bay of Gracias, in 1793, has said that, from circumstances which he has explained, the depth of this bay is gradually diminishing, and it is possible, that, in a few years, it may be filled up, so much as to prevent vessels from taking the shelter, which has heretofore been so useful, during the *Norths*, or North winds.

19. RIO and GOLFO DULCE.—For description of this river and the Gulf see *Colombian Navigator*, Vol. III., p. 295—300. The entrance is obstructed by a bar of mud and sand, over which is not more than 6 feet of water, and a vessel cannot enter before the sea-breeze sets in.

20. HALF-MOON KAY.—The kay is low and bushy. The lighthouse upon it, erected in 1821, exhibits a fixed light, at about 50 feet above the sea, and is useful to strangers bound to Balize as well by day as by night; for it very frequently happens that they get considerably to the southward of the fairway, owing to the indraught to the south-westward, &c. The lighthouse is situate on the eastern point of the KAY, and resembles a pyramid, being 22 feet square at the base, and diminishes to the lantern to $10\frac{1}{2}$ feet. The whole is neatly shingled and painted white, but the light is a very inferior one, and not visible more than two leagues off. The branch pilots for Balize have their station on this kay, and will come off on a vessel's approaching.

21. TURNEFF.—This is an assemblage of low islets and drowned land, covered with mangrove trees, and extending ten leagues N. by E. and S. by W., from one to two in breadth, and making from a distance like a number of islands. The eastern part is enclosed by a reef, steep-to. Kay Bokel is the southernmost islet off the southern part; it is of sand, very small, low, and has a few cocoa-nut trees upon it. Here, if requisite, a vessel may anchor for the night, in 5 or 6 fathoms, with the kay bearing E.S.E. about one mile.

22. ENGLISH KAY is situate on the south side of the Channel leading to Balize. It is a small, low, sandy kay, with a few thatched houses on it, entirely shaded with trees. On it is a flagstaff, 60 feet high, by which, on the approach of any vessel, signals are made to the court-house at the town of Balize, from which its distance is $12\frac{1}{2}$ miles. On the opposite side of the channel, N. by E., half a league, is *Goff's Kay*, a small low corally islet, with a little bush and one or two cocoa-nut trees upon it. This kay has some resemblance to a saddle; at about half a mile to the eastward of it is a little sand patch, nearly even with the water. Here strangers anchor, as it is impossible for them to proceed farther inward without a pilot.

23. ST. GEORGE'S KAY.—This kay, at about $7\frac{1}{2}$ miles northeastward from Balize, is a most agreeable and healthy spot, and contains a number of good houses. It is much resorted to, during the hot months, as a place of convenient retirement, by the inhabitants of the settlement. The purity of the air, and other advantages connected with it, render it likewise a desirable retreat for the sick and convalescent. The kay may be easily distinguished

guished by its houses and buildings. It lies two miles westward of the main reef, and S.E. of it is anchorage within the reef, at about a mile and three-quarters from the kay, in 4 and 5 fathoms; but which cannot be taken without a pilot.

24. **NORTHERN TRIANGLE.**—This is an extensive reef, of an oval shape, between the parallels of $18^{\circ} 23'$ and $18^{\circ} 47'$, and having its broadest part in $18^{\circ} 40'$. The channel between its western edge and the shore of Yucatan is 16 miles wide, and is the channel commonly taken by vessels from Balize, when bound to the northward, if not impeded by northerly winds: with the latter they proceed to the eastward.

"January 15th, 1831, saw the two kays on the north end of the Triangle, which are low and flat, and may be seen four leagues off. On the centre of the reef is a long low kay, called Long Kay; and at the south end is a bank of white sand, about 6 feet from the surface of the water, and for which, on approaching, a good look-out must be kept. To run betwixt it and the main steer N.N.W., then haul, after passing it, to the northward; but the edge of the reef is a good guide, as the eye defines it by the colour of the water."
—*Edw. Dunsterville.*

25. **COSUMEL**, between the parallels of $20^{\circ} 16'$ and $20^{\circ} 36'$, is 8 leagues in length. It is low and flat, but covered with trees, uniformly about 70 feet high; uninhabited, and does not appear capable of cultivation. There are several lagoons upon it. At about four miles from the N.E. point to the southward are the remains of a building, like a church, which, from the seaward, resembles an old fortification. The passage between the isle and the main is perfectly clear of danger.

26. **CAPE CATOCHE.**—The coast in the vicinity of this cape was surveyed by Captain Edward Barnett, commanding H.M.S. *Thunder*, in 1838, as noticed in the *Colombian Navigator*, Vol. III., page 317.

27. **MONTE NOTE-PERDERAS** is the most remarkable land on the peninsula of Yucatan. It is a little mount, of an oval shape, lying five miles to the westward of Sisal castle; and at a little to the westward of it are several similar risings in the land, which sufficiently denote this part of the coast, and are a guide to ships passing this shore; as, by keeping them in sight from the deck, your safety will be insured from the Sisal shoal.—*Colombian Navigator*, Vol. I., page 142. It has, however, been lately shown that the mark has become indistinct, from the ravages of an insect, by which the trees have been destroyed.

28. **CAMPECHE.**—The position is from the Journal of Admiral Mackellar, which corroborates that of the Spanish officers.

29. **ALVARADO, &c.**—During the late arduous contest for the independence of Mexico, the harbour of Alvarado became one of the chief places of trade in the Mexican Sea. It is a bar-harbour, with about 12 feet on the bar, which generally has a heavy breaking sea on it, and of course, is very dangerous. See further, on this subject, the '*Colombian Navigator*,' Vol. I., page 160.

30. **VERA CRUZ.**—There is a most excellent revolving light on the N.W. corner of the castle of S. Juan de Ulua. The machinery was made in London, and there is a spare set, lest any accident should befall that now in use. The centre of the lantern is elevated 79 feet above the level of the sea; the light is from 21 lamps, having reflectors, 7 on each side of a triangle, which make the revolution as follows: From the first appearance of light, it appears bright for about six seconds; then a faint glimmering for forty seconds, and so on alternately. This light may be seen 12 miles off in clear weather.

St. Juan de Ulua. S. $\frac{1}{2}$ W. by compass, 5 miles. (Sketched by Lieut. John Evans (a) R.N.)



Lighthouse.

Vera Cruz.

The tower is round, painted red and white, in vertical stripes, with a green top. See *Colombian Navigator*, Vol. I., page 164.

31. **PEAK OF ORIZABA and COFRE DE PEROTE.** The situations of these celebrated mountains are indicated in the Charts. The first, which is always covered with snow, is stated, by the Spanish surveyors, to be 6517 varas (2981 English fathoms) in height, above the level of the sea, and its highest point may be seen, above the horizon, at the distance of 50 leagues. Its true bearing and distance from Vera-Cruz are W. 9° S. 61 miles. This mountain, of a conic form, became volcanic in 1545, and continued for twenty years, since

since which time there has been no appearance of inflammation. Though the summit be clothed with perpetual snow, the sides are adorned with beautiful forests of cedars, pines, and other trees.

The *Cofre de Perote* is stated to be 2332 English fathoms high, above the level of the sea. Its distance from the nearest part of the coast is about 13 leagues.

32. MEXICO.—In the old maps, charts, and tables, this city is placed a degree too far to the westward: the sea-coast was also placed nearly as much too far to the west. The difference is shown by the map of the Mexican provinces, constructed by M. de Humboldt.

33. TAMPICO is of very difficult ingress and worse egress, as the depths on the bar and in the river are constantly in a state of change. You may know when you are off the bar by the bottom being of soft blue mud, without sand, on which you may safely anchor in from 9 to 10 fathoms, until day light, or till the sea-breeze sets in, when the vessel can be placed in a good position, either for passing the bar or discharging her cargo outside, if requisite. The depths on the bar vary from 8 to 14 feet, the least being in the rainy season.

The land to the southward of the bar is not sand-hills, as may have been supposed, but a regular range; which at the highest part, is about 350 feet above the sea, covered thickly with trees, excepting two small patches. It decreases more in height toward the bar than to the southward. Near the bar, the land is lower than on any other part of the coast. See *Directions and Chart in the Nautical Magazine*, Jan. 1834.

It has been announced that a company in Tampico are taking measures to procure steam-boats for towing vessels over the bar (1834).

VARIATION OF THE COMPASS.—Near Cayenne the variation was $2^{\circ} 29'$ E. in 1834: at Demerary it was $4^{\circ} 50'$ E. in 1835. From the Island of Trinidad, where the easterly variation is about 3° , that variation is found to increase to the westward. By observations made in and subsequent to 1816, it has been found to exist as follow: At Cape Vela, and thence to Chagre, from 6° to $6\frac{1}{2}^{\circ}$ E.; at the Isle of St. Andrew, in 1834, 7° E.; Golfo Dulce, $7\frac{1}{2}^{\circ}$ and Bay of Honduras, $7^{\circ} 25'$ E.; at Vera Cruz, 9° E.; and at Tampico, $8\frac{1}{4}^{\circ}$ E., in 1833.

SECTION II.

GENERAL OBSERVATIONS *on the* WINDS, TIDES, and CURRENTS, *and on the* DIFFERENT PASSAGES, *over the* ATLANTIC OCEAN.

1.—OF THE WINDS AND TORNADOES.

WINDS IN GENERAL.—As the earth, by its diurnal rotation on its axis, presents, in succession, every part of its circumference to the sun, the heat of that luminary, by rarefying the air, is found to be the chief cause of winds. For as the air is a fluid, subjected to the same laws of gravitation as other fluids, it has a constant tendency to preserve an equilibrium in every part: so that if, by any mean, it be rendered lighter in any one place than another, the weightier air will rush in from every side, until as much be accumulated as makes it of an equal weight with the rest of the atmosphere. These currents of air are called WINDS.

The Winds are divided into PERENNIAL, PERIODICAL, and VARIABLE. They are also divided into General and Particular. PERENNIAL, or Constant, Winds, are those which always blow the same way; such is that easterly wind, between the tropics, commonly called the TRADE-WIND. PERIODICAL WINDS are those which constantly return at certain times: such are land and sea-breezes, blowing alternately from land to sea, and from sea to land. VARIABLE, or Erratic, Winds, are such as blow now this way, now that, and are

are now up, now hushed, without regularity either as to time or place: such are the winds prevalent in England, &c.

WINDS are generally found to vary according to the situation of land; for the temperature of the land, according to the degree to which it is heated by the sun, always affects the disposition and strength of the wind. Thus, it is found that the heated land of Africa, by rarefying the atmosphere, produces a breeze from the sea; and from this circumstance it arises, that lands, which would otherwise be parched up or burnt, are rendered habitable. It is observed, generally, that the continental coasts, between the tropics, are almost always blown upon *obliquely*, from seaward, by winds whose course is affected by the winds which prevail in the extensive seas that surround them. It is even well known, as a fact, that, during the greatest part of the summer and autumn, the wind blows from the north along the western coasts of PORTUGAL and SPAIN, so that the passage from Lisbon to Falmouth is seldom accomplished in less than a fortnight, and often occupies more.

PERENNIAL or TRADE-WIND.—But, over extensive tracts of ocean, *remote from land*, and in the lower latitudes, or toward the equator, Perennial or Trade-Winds are found to prevail, which follow the course of the sun: thus, on the Atlantic Ocean, at about 100 leagues from the African shore, between the latitudes of 10 and 26 degrees, a constant breeze prevails from the north-eastward. Upon approaching the American side, this N.E. wind becomes more easterly, or seldom blows more than one point of the compass from the East, either to the northward or southward. This appears to be caused by the heated lands to the westward rarefying the air, and causing an indraught that way, as a contrary wind is induced on the African Coast.

The PERENNIAL or TRADE-WIND, on the American side of the Atlantic, extends, at times, to 30 degrees of latitude, which is about 4 degrees farther to the northward than on the African side. Likewise on the south of the equator, the Perennial Wind, which is here from the south-east, extends 3 or 4 degrees farther toward the Coast of Brasil than on the opposite side of the ocean.

The general cause of this wind is the motion of the earth, in its diurnal rotation, which thus presents, in succession, every part of its circumference to the sun; and the atmosphere becoming successively heated, a constant stream is thus produced. This is sufficient to show, that, in the regions near the equinoctial line, a constant rarefaction is produced by the sun, and a current of air consequently follows that luminary in his progress from East to West.

HEAT increases evaporation, and renders the atmosphere capable of supporting a greater quantity of moisture than it would do in a cooler state: this is a powerful agent in the causes which produce a diversity of winds and weather, especially to the northward and southward of the tropics; for, by this addition of moisture, the air is more fully expanded, and become specifically lighter, than it would be in the same degree of heat in a drier state.

Were the atmosphere of one continued warmth, and its motion uniform, there would be no rain; for it would not imbibe more moisture in exhalation than it could support; therefore, in a perennial wind, notwithstanding the great evaporation, there is seldom any rain; but, from accidental causes, these winds are alternately stronger and weaker, with frequent clouds, and sometimes light showers.

These circumstances are assumed as prevailing at a considerable distance from the land, and from the limits of the perennial wind; for, every where near the land, when the sun has great influence, it occasions land and sea-breezes near the shores; and, in particular situations, heavy gusts and squalls of wind. The Trade-Winds are more steady and uniform in the Pacific Ocean, from its greater extent, and also in the Ethiopic, than in the Atlantic Ocean, where Cape Verde and the broad part of Africa extend so much to the westward, and the northern part of Brasil, in America, to the East.*

Small

* We have been asked, by an intelligent friend, If the rotatory motion of the Earth be not the cause of the Trade-winds, and also of westerly winds prevailing so much in the higher Northern and Southern latitudes? The atmospheric air seeking to regain its equilibrium where the rotatory velocity of the globe least opposes it? Again, will not the same principle apply to the westerly Equatorial current of the sea, and the general easterly currents of the southern and northern hemispheres about Cape Horn and from Hudson's Bay?

It is not the purpose of this work to enter into *theoretic* disquisitions on general subjects, and we there.

Small islands, lying at a great distance from the main land, operate very little upon the Trade-Wind. If elevated, these islands are more subject to rain than if low: this may be occasioned, principally, by the ascent given to the wind, or atmosphere, in rising over the tops of the hills; when, being cooled, it condenses into small drizzly rain. This is an effect peculiar to all mountains, even in the middle of continents, when the atmosphere is sufficiently charged with moisture. For the sun's rays, by heating the atmosphere, according to its density, renders it much warmer at the bottom than at the top of hills. Upon a mountain, sloping from the sea toward the top, and about 700 yards in height, a pleasant breeze has been observed in-shore, and fine clear weather; but the air in ascending, being condensed by cold, at about half-way up, had the appearance of fog, or thin light flying clouds; and at the top was a misly rain: this may frequently be seen in any mountainous country.*

The clouds, in the higher regions of the air, are frequently seen to move in a direction contrary to the wind below. The reason of this variation is, that the cool dense air below forces the warm and rarefied air upward, where it spreads so as to preserve the equilibrium; and hence the upper course, or current, appears in a contrary direction. Thus circulating, the N.E. Trade-wind has frequently a S.W. wind above it: and a S.E. wind often prevails beneath one whose direction is N.W. It is consequently found, that, just without the limits of the Trade-wind, the wind generally veers about until it blows from the opposite quarter. The counter-current of air, above, is often seen in a fresh Trade-wind; for the great power of the sun between the tropics so rarefies the atmosphere under his meridian, that it has not so much influence in the upper region, where the atmosphere is light: hence the motion of the upper part takes its direction contrary to the Trade-wind.†

Mr. Dunsterville has noticed that, when approaching the West-Indies, the wind invariably, on advancing northward from the trade-winds, veers to the southeastward, thence round to S.W. and westward; and, in the winter months, even to N.W. and N.N.W.

Colonel Reid observes ‡ (page 120) that "it is only necessary to prove that the winds are rotatory, and that by some fixed law of nature they revolve uniformly in the same way, and we are enabled to assign a cause for the variable winds;" but Captain Fitzroy asks, "Are not storms exceptions to the general winds, or atmospheric currents; not the causes of them? Variable winds are almost continual, except during short intervals of calm; but

therefore say only, It has been stated, and generally admitted, that the trade-winds may be occasioned by the rotatory motion of the Earth on its axis, combined with the influence of the sun in rarefying the atmosphere between the tropics. "The cold dense air of the polar regions would naturally move along the surface of the globe to take the place of the hot rarefied air at the Equator; but the Earth's rotatory motion, and the gradually increasing velocity of this motion at its surface, from the poles to the Equator, compel these polar currents of air to diverge from their meridians on their route to the Equator, and ultimately to acquire a direction from East to West.

"From the rotation of the Earth, the sun's apparent diurnal motion is from East to West: consequently the points of greatest rarefaction must move in the same direction with that luminary, the atmosphere being greatly heated, in a continued succession, under every part of the sun's passage over the Earth. The places, therefore, of greatest rarefaction following the sun from East to West, the denser must move toward them, and thus occasion a constantly easterly wind in the ocean remote from land between the tropics."—*Captain Horsburgh.*

* *Oriental Navigator*, or *East-India Directory*.

† *The Causes of Tornadoes, Hurricanes, and Squalls*, have been thus assigned by Dr. HARE, of Philadelphia:—The air, being a perfectly elastic fluid, its density is dependent on pressure, as well as on heat, and it does not follow that air, which may be heated in consequence of its proximity to the earth, will give place to colder air from above. The pressure of the atmosphere varying with the elevation, one stratum of air may be as much rarer by the diminution of pressure consequent to its altitude, as denser by the cold consequent to its remoteness from the earth, and another may be as much denser by the increased pressure arising from its proximity to the earth, as rarer by being warmer. Hence, when unequally heated, different strata of the atmosphere do not always disturb each other. Yet, after a time, the rarefaction in the lower stratum, by greater heat, may so far exceed that in the upper stratum, attendant on an inferior degree of pressure, that this stratum may preponderate and begin to descend. Whenever such a movement commences, it must proceed with increasing velocity; for the pressure on the upper stratum, and, of course its density and weight, increases as it falls; whilst, on the contrary, the density and weight of the lower must lessen it as it rises, and hence the change is, at times, so much accelerated as to occasion the furious and suddenly varying currents of air which attend tornadoes, hurricanes, and squalls.

Silliman's Journal, No. 12.

‡ "Law of Storms," an important work, particularly noticed hereafter.

hurricanes,

hurricanes, or even ordinary storms, are rare. May not opposing or passing currents cause eddies, or whirls, on an immense scale, in the air, not only horizontal, but inclined to the horizon, or vertical?"

"In most, if not all, of the storms to which I can bear any testimony, currents of air arriving from different directions appeared to succeed each other or combine together. One usually brought 'the dirt,' to use a sailor's phrase, and another cleared it away, after driving much of it back again, often with redoubled fury. One of these currents was warm and moist,—another cold and dry,—comparatively speaking. While one lasted, the barometer fell or was stationary; with another it rose. At all places I have visited, or of which I have obtained notices on the subject, the barometer stands high with easterly, and comparatively low, with westerly winds, on an average. Northerly winds in the northern hemisphere affect the barometer, like southern winds in the southern hemisphere."—*Captain Fitzroy's Appendix to his Narrative of the Voyage of the Beagle*, page 277.

The space from latitude 25° to 28° or 29° , between the Variable and Trade-winds, is remarkable for a continual change of winds, with sudden gusts and calms, rain, thunder, and lightning. This space has been called the *Horse Latitudes*, because it has often been found necessary here to throw overboard the horses which were to be transported to the West Indies, &c. To the northward of these latitudes, upon the American Coast, and more than one-third over the Atlantic, westerly winds prevail nearly nine months in the year.

In the latitudes above the Trade-winds, the wind from the W.S.W.ward being replete with moisture, from the great exhalation between the tropics, as it approaches the cold and higher latitudes, becomes condensed into showers of hail, rain, or snow. For instance, in the 50^{th} degree of North latitude, the wind from the S.W. generally will prevail till the atmosphere is more condensed than in the lower latitudes; the wind from the colder region then ensues, and blows till the equilibrium of the atmosphere is restored, when a short calm generally succeeds before the wind shifts into another quarter.

There is often an interval of calm between the Trade-winds and the opposite winds in high latitudes. This is not, however, always the case; for, if the Trade-wind in its borders be much to the eastward, it frequently changes gradually round without an interval of calm. There is generally, also, a calm in a certain space between two prevailing winds blowing in opposite directions, as between the Trade-wind and the westerly wind on the African Coast. In the limits of the Trade-wind, a dead calm is generally the prelude to a storm, and it ought always to be considered as a prognostic thereof; for it is known that the conflux of the Trade-wind and the variable winds is the cause of calms and storms in the tropical regions.

When the sun is at its greatest declination, North of the equator, the S.E. wind, particularly between Brazil and Africa, varying toward the course of the sun, changes a quarter or half a point more to the southward, and the N.E. Trade-wind veers more to the eastward. The contrary happens when the sun is near the southern tropic; for then the S.E. wind, South of the line, gets more to the East, and the N.E. wind, on the Atlantic, veers more to the North. In June, July, August, and September, while the sun is returning from the northern tropic to the equator, the action of its rays upon the land and sea, in the northern part of the globe, renders the wind less constant by altering the state of the atmosphere.

On the African side, the winds are nearest to the South, and on the American side, nearest to the East. In these seas Dr. Halley observed, that, when the wind was eastward, the weather was gloomy, dark, and rainy, with hard gales of wind; but, when the wind veered to the southward, the weather generally became serene, with gentle breezes, next to a calm.

The EQUATORIAL LIMITS of the N.E. Perennial or Trade-wind between the meridians of 18 and 26 degrees west, have been found, upon the comparison of nearly 400 journals, English and French, to vary considerably, even in the same months of the year. We have shown, on the Chart, where the N.E. Trade, according to the probable mean, may be expected to cease in the different months: but the annexed Table will be found to answer the purpose more precisely.

In this Table the columns of *Extremes* show the uncertain termination of the Trade-winds,

winds, as experienced in different ships. The annexed columns show the *Probable Mean* : and the last column exhibits the mean breadth of the interval between the N.E. and S.E. winds.

Thus, the Table shows, that, in the month of January, the N.E. trade has been found sometimes to cease in the parallel of 10° , and sometimes in that of 3° N. That the probable mean of its limit is about 5° N.—That the S.E. trade, at the same time, has been found to cease sometimes at only half a degree North of the line, and sometimes at 4 degrees. That the probable mean of its limit is, therefore, two degrees and a quarter. And, that the interval between the assumed means of the N.E. and S.E. Trade-winds is equal to $2\frac{1}{4}$ degrees : and so of the rest.

TABLE showing the EQUINOCTIAL LIMITS of the N.E. and S.E. TRADE-WINDS, between the MERIDIANS of 18 and 26 DEGREES WEST.

N.E. TRADE-WIND.			S.E. TRADE-WIND.		INTERVAL BETWEEN.
CEASES,	General Extremes.	Probable Mean.	General Extremes.	Probable Mean.	Mean Breadth.
In January at ...	3° to 10° N.	5° N.	$0\frac{1}{2}^{\circ}$ to 4° N.	$2\frac{3}{4}^{\circ}$ N.	$2\frac{1}{4}$ degrees.
February	2 to 10 —	4 —	$0\frac{1}{2}$ to 3 —	$1\frac{1}{4}$ —	$3\frac{1}{4}$
March	2 to 8 —	$4\frac{3}{4}$ —	$0\frac{1}{2}$ to $2\frac{1}{2}$ —	$1\frac{1}{4}$ —	$3\frac{1}{4}$
April	$2\frac{1}{2}$ to 9 —	5 —	0 to $2\frac{1}{2}$ —	$1\frac{1}{4}$ —	$3\frac{3}{4}$
May	4 to 10 —	$6\frac{1}{2}$ —	0 to 4 —	$2\frac{1}{2}$ —	4
June	$6\frac{1}{2}$ to 13 —	$8\frac{1}{2}$ —	0 to 5 —	3 —	$5\frac{1}{2}$
July	$8\frac{1}{2}$ to 14 —	11 —	1 to 6 —	$3\frac{1}{2}$ —	$7\frac{1}{2}$
August	11 to 15 —	13 —	1 to 5 —	$3\frac{1}{4}$ —	$9\frac{3}{4}$
September ..	9 to 14 —	$11\frac{1}{2}$ —	1 to 5 —	3 —	$8\frac{1}{2}$
October	$7\frac{1}{2}$ to 14 —	10 —	1 to 5 —	3 —	7
November	6 to 11 —	8 —	1 to 5 —	3 —	$4\frac{1}{4}$
December ...	3 to 7 —	$5\frac{1}{2}$ —	1 to $4\frac{1}{2}$ —	$3\frac{1}{4}$ —	$2\frac{1}{4}$

In the space of variable winds between the trades, exhibited in the last column, it has been found that southerly winds prevail more than any other, more particularly when the sun has great northern declination. Homeward-bound East-India ships are therefore enabled, at this season, to cross the space more quickly than those outward-bound; which they do, in some degree, at all other times. Yet calms and variable winds are experienced in every month of the year, within this space; but the former, which are more generally in the vicinity of the N.E. trade, seldom continue long. These calms are frequently succeeded by sudden squalls; against which every precaution should be taken; as many ships have lost their topmasts, and have been otherwise damaged by them. Whirlwinds have sometimes accompanied these squalls in their first effort against the resisting atmosphere.

It has been stated as probable, that a gale of wind, or storm, never happens hereabout far from land, or near the equator in the open ocean, on any part of the globe; although, in its vicinity, sudden gusts of wind and whirlwinds are sometimes experienced. S.W. and W.S.W. winds, with much rain, are frequent in July, August, and sometimes in June and September.

The heated land of Africa within Cape Verde, with the Cape Verde Islands, produce in the vicinity the variable winds, and occasional calms, which counteract the trade-wind to a considerable distance from the coast. Hence it happens, that ships, which approach too near the coast or islands, lose the trade-wind sooner than those which keep at a greater distance. To guard against this, it has been recommended to commanders, to keep well to the westward when the N.E. trade fails; but some, in observing this precept, have crossed the line too far to the west; for, meeting with the S.E. trade, hanging far from the southward, with strong westerly currents, they have made the coast of Brasil, and been obliged, in consequence, to tack to the eastward.

It has been stated, and generally understood, that, at the eastern end of the interval, between the N.E. and S.E. trade-winds, there is a continual succession of calms, terrible thunder, lightning, water-spouts, and such frequent rains, that this portion of the ocean has been denominated THE RAINS. Ships have here, it is said, been detained for months, in passing between the latitudes of 10 and 4 degrees. The cause appearing to be, that the westerly winds, setting for the coast, and the easterly winds, here balance each other, and produce the calms; while the vapours, meeting and condensing, produce the almost ceaseless rains.

The words of *M. la Pérouse*, on his crossing the line, after passing Cape Verde, &c., are, in this place, worthy of particular notice. He says, "Nothing particular occurred during our passage to the line. The trade-wind left us in 14° North, and the wind then constantly blew between W. and W.S.W. till we reached the line, and obliged me to run down the coast of Africa, which I did at the distance of 60 leagues.

"We crossed the line on the 29th of September, 1785, in 18° West longitude (15° 40' W. of Greenwich.) I could have wished, as my instructions were, to have passed it more to the westward; but, fortunately, the wind drove us always to the eastward, otherwise it would have been impossible to have made Trinidad,* the wind being S.E. at the line, and continuing so until we reached latitude 20° 25' S.

"The dread, which some navigators entertain, of being, at this season, becalmed under the line, is founded on error. We were not a day without wind, and once only had rain; when, indeed, it was so abundant as to fill twenty-five casks.

"The fear of being driven too much to the eastward into the Gulf of Guinea is equally chimerical. The S.E. wind is soon met with, and even drives ships too rapidly to the westward; so that, had I been better acquainted with this navigation, I should have steered away more large with the S.W. wind, which constantly prevailed to the north of the line; and I should then have crossed it in the longitude of 10 degrees (7° 40' W. of Greenwich.) This would have permitted me to run, with a free wind, on the parallel of Trinidad. A few days after our departure from Teneriffe, we left the serene skies of the temperate zones; instead of which a dull whiteness, between fog and cloud, always prevailed. The horizon was contracted; but, after sun-set, the vapour was dissipated, and the nights were constantly fine."

REMARKS on the WINDS and CURRENTS to the NORTHWARD and SOUTHWARD of the EQUATOR, by Capt. J. W. MONTEATH.

In the month of March, 1818, on leaving St. Antonio, (Cape Verde Islands,) we shaped our course so as to cross the Equator on the meridian of 19° West. From that island the trade-wind continued steady from East to N.E. until in the sixth parallel of latitude: from this to the fourth parallel, the wind continued light from N.E. to North; and, to the second parallel, variable and squally, with heavy showers of rain. The current, between the third and second parallel, set S.E. by E. at the rate of 13 miles in twenty-four hours; and in 1° 30' N. set E.S.E. 10' in twenty-four hours. Gained the S.E. trade in latitude 1° 30' N., the wind from the S.S.E. to S.E.; between the parallels of 4° to 15° South experienced a westerly current of 80 miles in five days.

I perfectly agree with *M. Pérouse*, that the dread which some navigators entertain of being becalmed in these parallels and 19° West is erroneous.

We were only about forty-eight hours without wind, from the parallel of 4° North to the time of gaining the S.E. trade; during which time we had abundance of rain; so much so that we filled all our empty casks.

On my return voyage, in January, 1819, I crossed the equator on the meridian of 20° 30' West; we carried the S.E. trade until in the latitude of 4° 30' North, at which parallel, in longitude 22° 30' West, I found the current setting North by West at the rate of one mile and a half per hour.

This will point out the disadvantage of crossing the equator on this meridian, as a vessel would be set to the northward, as fast as the light winds would carry her southward.

* The little Isle of Trinidad, lying in 20° 31' S. and 29° 19' W.

PERIODICAL WINDS, &c.—Among the Canary Islands, northerly or N.E. winds mostly prevail; yet, being in the vicinity of the continent, westerly and southerly have been found to prevail there, sometimes for eight days successively.

During the months of November, December, January, February, and March, the winds from the East and N.E. are prevalent in the country between Cape Blanco and the entrance of the River Gambia. In this time the nights are cool; but scarcely has the sun arisen above the horizon, when the air becomes dry and parching. Nevertheless, these five months are the winter in this part of Africa, and this is the most healthy season. Between the Gambia and Cape Palmas, the inland winds, during the same season, are variable.

In June, July, August, September, and October, the country situated between Cape Verga and Cape Mount is much exposed to hurricanes or tornadoes. These, however, do not occur in any part of the coast northward of Cape Verga.

From the 20th degree of North latitude to the environs of the line, the months of July, August, September, and October, are those of the rainy season, when the atmosphere emits its waters to the earth; the only difference is, twenty days sooner or later in the arrival of these torrents. During the other eight months in the year there does not fall a single drop of water.

On the AFRICAN COAST, from Cape Blanco to Sierra Leon, the winds, at sea, excepting storms or land-breezes, have been stated to blow mostly rather from N. to N.W. than from the north to the eastward.

Between the CAPE VERDE ISLANDS, and in their neighbourhood, southerly and S.W. winds generally blow in July, August, September, and October. These islands, when the sun is in their zenith, are generally surrounded by thick fogs.

From SIERRA LEON to CAPE PALMAS, the ordinary course of the winds on the coast is from W.N.W. and beyond Cape Palmas, from W.S.W. to S.W. and S.S.W.

Although, in the Gulf of Guinea, the winds blow generally from the southward, and S.S.W. toward the coast, they take, in south latitude, a more westerly direction near the land, and often prevail from S.W. and W.S.W. between Cape Lopez and Benguela. But they veer proportionally more southerly as the distance increases from the coast.

WINDWARD COAST, &c.—The name of *Windward Coast* has been given by our navigators to the whole of that coast which extends from Cape Mount to the River Assinee, where the Gold Coast commences: it includes the three particular coasts called, 1st, Grain or Pepper Coast; 2d, Ivory or Teeth Coast; 3d, the Coast of Adou, or Quaqua.

From January until May, the weather here, along shore, is commonly fair and clear, with cooling breezes, and gentle southerly winds. But, about the middle of May, South and S.E. winds begin, accompanied not only with hurricanes and stormy gusts, but also with thunder, lightning, and great rains, which continue, more or less, until the conclusion of the year.

On the Gold Coast, from Assinee to the River Volta, the wind, in January, begins to blow from the S.W. quarter, and becomes stronger in February, bringing with it sometimes rain, and sometimes a hurricane. About the end of March, and beginning of April, those heavy tempests, called, by the Portuguese, *tornadoes*, arise, accompanied with a deluge of rain, thunder, lightning, and sometimes with earthquakes; these continue to the end of May, and are announced by the darkness of the sky in the S.E.

During the rainy season, that is, in May and July, little or no land-winds are felt; but, from the sea, it blows from the S.W. and W.S.W., making a very great swell, which continues even in August, although the rains begin to cease in that month.

The weather becomes fair in September, and the air clear, with gentle south winds: and this continues till January, the hottest days being in December.

On the Gold Coast, as well as the Windward Coast, an easterly wind, called the *Harmattan*, prevails during the months of December, January, and February. This wind comes on indiscriminately, at any hour of the day, at any time of the tide, at any period of the moon, and continues sometimes only a day or two, sometimes five or six days, and it has been known to last fifteen or sixteen days. There are generally three or four returns of it in every season: it blows with a moderate force, not quite so strong as the sea-breeze, which

which every day sets in, during the fair season, from the West, W.S.W., and S.W.; but somewhat stronger than the land-wind, at night, from the North and N.N.W. In the Philosophical Transactions, Vol. 71, for the year 1781, an account of the *Harmattan* was first given by *Matthew Dobson*, M.D. F.R.S., from the inquiries and observations of *Mr. Norris*, of which the following is the substance :

“ On that part of the coast of Africa which lies between Cape Verde and Cape Lopez, a singular periodical easterly wind, named, by the natives, the *Harmattan*, prevails during the months of December, January, and February. Cape Lopez lies to the southward of the line. At the Isles de Los, which lie to the northward of Sierra Leon, this wind blows from the S.S.E.; on the Gold Coast, from the N.E.; and, at Cape Lopez and the River Gaboon, from the N.N.E.

“ The *Harmattan* comes on as above described. A fog or haze always accompanies it, and the gloom is sometimes so great as to render near objects obscure. The sun is thus concealed the greatest part of the day, and appears only a few hours about noon, and then of a mild red colour. At two or three miles from shore, the fog is not so thick as on the beach; and, at four or five leagues’ distance, it is entirely lost, though the *Harmattan* is felt for ten or twelve leagues, and blows fresh enough to alter the course of the current.

“ Extreme dryness is a property of this wind. No dew falls during its continuance, nor is there the least appearance of moisture in the atmosphere. All vegetables are much injured, and many destroyed. The seams in the sides and decks of ships become very leaky, though the planks are two or three inches thick. Iron-bound casks require the hoops to be frequently driven tighter, and a cask of rum or brandy can scarcely be preserved: for unless kept constantly moistened, the hoops fly off. The *Harmattan* has, likewise, very disagreeable effects on the skin, lips, and nose, which become sore.

“ The effects of the *Harmattan* in evaporation are great; as will appear by the following comparative statement:—At Liverpool, the annual evaporation is about 36 inches; at Whydah, 64 inches; but, under the influence of the *Harmattan*, 133 inches.

“ This wind, though so prejudicial to vegetable life, is highly conducive to health; so that fluxes, fevers, small-pox, &c., generally disappear in spite of the doctor; and it contributes to the cure of ulcers and cutaneous eruptions. The baneful effects which have been said to arise from the prevalence of this wind, proceed from the periodical rains, which fall in March, April, &c., and are ushered in by the tornadoes from the N.E. and E.N.E., accompanied with violent thunder and lightning, and very heavy showers. The earth, drenched by these showers, and acted upon by an intense solar heat, so soon as the storm is over, sends forth such noisome vapours as are the occasion of putrid fevers, and other diseases.

“ On this coast, from the middle of February to the first week in March, a wind up the coast, from S.S.W. to S.S.E. prevails for about three weeks. The Tornado season is part of March, all April, and the greater part of May, about twelve weeks. The rainy season is from the latter end of May, all June, and to about the 20th of July, about eight weeks. Hence, high wind and squally, with very heavy rains, to the middle of August, about three weeks. The rain ceases, and then, for the first three weeks in September, the weather is foggy and close, without any breeze. From this time, for about six weeks, the wind blows fresh down the coast; the tornadoes and southerly wind then succeed, with some rain, generally called the *lutter rains*, about four weeks, to the beginning of December, when the *Harmattan* season commences.”

The prevailing winds in the western part of Africa and Gulf of Guinea are distinguished, by the natives, as follow :

AHERRAMANTII, or *Harmattan*, prevailing about ten weeks, from the 1st of December to the middle of February.

INAKERA, a wind upon the coast from S.S.W. to S.S.E. from the 1st of March to the equinox.

PEMPINA, the tornado season, from March until the end of May, about twelve weeks.

ABRENAMA, June and July, eight weeks, the rainy season, by the natives called the Old Man’s, Woman’s, and Children’s season.

ATUKOGAN. High winds and squalls, with heavy rains to the middle of August, three weeks.

WORROBOKORON. The rains cease, three weeks.

MAWARAH.

MAWARRAH. Close foggy weather in September, three weeks.

BOUCH. No land-breeze; the wind fresh down the coast for six weeks.

ANTROPHI. Frequent tornadoes southerly, some rain, called the latter rains, four weeks, continuing to the beginning of December, when the Harmattan commences.

REMARKS *on the SEASONS and WINDS which prevail on the Coast of AFRICA, between CAPE BOJADOR and the ISLES DE LOS; by the BARON ROUSSIN, 1817.*

“**SEASONS.**—On the whole extent of the African Coast, there are but two seasons; namely, the RAINY and DRY SEASONS. The division of the two is connected with the periods when the sun crosses from one hemisphere to the other, and is modified as he advances to, or recedes from, the Equator.

The RAINY SEASON.—The Rainy Season commences at each place on the Coast to the northward of the Equator, at the time when the sun passes the zenith of that place in his course to the northward. It is usually, during the month preceding this event, that the change of weather takes place. It may, therefore, be calculated, that, at the Isles de Los, the first point exposed to the rainy season, and which lie in $9\frac{1}{2}^{\circ}$ N., the first violent squalls do not occur before the 10th or 15th of May; their arrival seems to be affected by the moon; for they almost always commence, and are most violent, on the days of new and full.*

The Rainy Season ends in very violent squalls with intervals of calm, of which there are at least two, and frequently more, during the twenty-four hours; and we remarked, that they generally happen on the rising or setting of the sun or moon. In the country, these squalls are generally called *tornadoes*, but according to the best information, the tornado, properly speaking, is to be met with only to the southward of Cape Verga. They generally begin to form themselves in the N.E. or E.N.E. quarter of the horizon, which seems completely on fire during an hour or more. The storm then gradually shifts round to E. and E.S.E., becoming darker in the horizon. Having arrived at S.E., it attains its full vigour, when thunder and lightning become incessant. A moment of absolute calm then takes place, which is caused by the obstruction which the usual winds from the N.W. meet with from this immense mass of clouds. Shortly after a small arch is formed at the horizon, which increases and rises rapidly. The more defined the edge of this arch appears, the more violent will be the storm, as it is a proof that the column of air has divided much heavier clouds, and is more confined. When the summit of this arch has attained an altitude of about 45° , the hurricane bursts forth, and torrents of rain immediately follow. The crisis of its greatest violence generally lasts from fifteen to twenty minutes; it afterwards gradually becomes weaker; and finally nothing remains but rain, attended with very little wind. It then shifts round from S.E. to W.S.W., then to the quarter from which the usual winds blow, to exhaust itself to the northward in another squall from the S.E.

The RAINY SEASON, at any place, continues from four to six months, according to its proximity to the Equator, and the tornadoes continue to decrease both in frequency and violence during the two latter months of the season. In ten days or a fortnight after the sun has passed the zenith of any place on his way to the south, it is considered as free from bad weather. On the 15th of November, a gun is fired at Goree, which announces the return of the fine season.

The squalls here spoken of, and the winds which precede or follow them, generally occupying so very small a portion of the year, may be considered as momentary convulsions in a state of climate almost unchangeable; a sky nearly always serene and generally clear.

On the greater part of the African coast, from Cape Bojador to the Isles de Los, regular winds blow, and no rain ever falls during eight months. The prevailing winds in this country blow from N.E. to N.W., it may therefore be said, that they follow the

* See, further, upon this subject, our *Sailing Directory for the Ethiopic or Southern Atlantic Ocean*, section the 6th.

direction of the coast from North to South, and that they seldom vary from the limits here assigned.

The DRY SEASON commences in the latter part of October at Senegal; a little later at Goree; and at each intermediate place toward the Equator it becomes gradually later. It is not till the beginning of December that its return is observed in the parallel of the Isles de Los.

THE HARMATTAN.—Although the winds from N.E. to N.W. prevail on the coast of Africa, during the dry season, that is, from November to May, they are, nevertheless, occasionally interrupted between the 1st of December and the 1st of February, by the land-wind which blows from E.N.E. to E.S.E., and sometimes with violence.

It is this wind which the inhabitants of the country call the *Harmattan*. It comes on at different periods in the above interval, and blows during one, two, and sometimes five or six, successive days. This continuance, however, is rare, as it is generally interrupted by the sea-breezes which commence about noon, after a calm of one or two hours. These alternate land and sea-breezes generally last till the end of February, when the usual winds entirely prevail. The Harmattan, which passes over the most arid country of the globe, is of an extremely dry nature; and would probably become insupportable, were it not frequently allayed by the sea-breezes above-mentioned. Notwithstanding the salutary effect of these breezes, the drought is astonishing so long as the Harmattan lasts. Mankind are inconvenienced; vegetables suffer so much as to be nearly killed; the sun loses his brilliance, and is only to be seen when near noon; the sand, brought with it from the desert, pervades the atmosphere, and prevents objects from being distinguished at the distance of a quarter of a mile. Nevertheless, the effect of the Harmattan is not really injurious to health; it is remarked that it even purifies the atmosphere, by destroying the noxious vapours with which it is replete on the conclusion of the rainy season. It is usually on the return of the Harmattan, that recovery commences from disorders which are incident to the climate.

The fog which accompanies the Harmattan, loses nothing of its density when three leagues out at sea. On the edge of the bank of Arguin, which is ten leagues from the land, it prevented our distinguishing the horizon during three successive days. This state of the atmosphere is not permanent, but varies with the winds which produce it; and in general, independent of the Harmattan, the African coast, from Cape Bojador to Cape Verde, is continually covered, during the whole dry season, with a white mist, which is seen from the sea much sooner than the land of which it is a sure indication. This mist, which is nothing but sand, the extreme fineness of which allows of its being supported by the least agitated air, is particularly remarkable on that part of the desert between the parallel of 22° and Senegal. We have seen it at the distance of five leagues, when the coast could scarcely be seen at three."

GENERAL REMARKS *made on the Coast between the ISLES DE LOS and SIERRA LEON, by Captain T. BOTELER, of H.M.S. HECLA, 1829.*

The ROLLERS.—The surf on this coast is extremely heavy; the *Rollers* sometimes curling in 5 fathoms, and breaking tremendously in 3 or even in 4. They may be, in general, expected between December and April, and chiefly about the times of new moon; and, therefore, during this interval, vessels should avoid anchoring in shallow water in unsheltered places, especially in the vicinity of a large river, as the opposite tide tends much to increase the danger.

The HARMATTAN SEASON sets in with November, or about a month earlier than off the Gambia, and prevails through December and part of January, but not quite constantly; for occasional intervals of clearer weather, accompanied by the refreshing sea-breeze from the N. W., sometimes afford a respite to its oppressive effects. Nor does the Harmattan blow uniformly, either in the same direction or with the same strength; for it ranges through eight points of the compass, from N.N.E. to E.S.E.; and, however fiery at the commencement, declines, after the first month, to a comparatively light breeze.

THE PECULIAR HAZE which more or less envelopes the coast of Africa at all times, is at its maximum during the influence of the Harmattan; and, though partially dispersed by the tornadoes and the rainy season, returns with increased density when they cease.

Strangers

Strangers should, therefore, be on their guard when estimating their distance from the land, as the deceptive effect of this haze makes it appear much farther off than it really is: for, the contrast which the coast presents to the eye, in different states of the atmosphere, is very great. In clear weather, the view of the fertile shelving hills in the Isles de Los, the stupendous features of the distant mountains, the plains covered with trees, and the beautiful little island of Matacong, (described hereafter,) are highly interesting; while in hazy weather, nothing is visible but a low mangrove coast, enveloped in mist, with an indistinct opening of a river here or there, or perhaps a column of smoke rising from a native village.

The RAINY SEASON continues for four months, from May to September; but the *Tornadoes*, which invariably accompany its commencement and termination, generally cease between those periods. They blow from the E.S.E., and with great fury; but they seldom last more than three hours. The prevalent winds during the rest of the rainy season are from the southward and westward, and are usually so light as to give way in the afternoon to the N.W. sea-breeze.

TORNADOES on the AFRICAN COAST, as described by M. Golberry.—“Between Cape Verga and Cape Palmas, and during the months of May, June, July, August, September, and October, the countries near the sea are frequently exposed to hurricanes, which the Portuguese have denominated *tornadoes*, and which have obtained this name even amongst the negroes. During my stay in the river of Sierra Leon, I witnessed one of these tornadoes, but it was not one of the most violent. These meteors happen a few weeks before the rainy season, and continue till the month of November. The countries above described are, therefore, exposed to them for nearly six months; and these whirlwinds are more or less frequent, and of different degrees of violence, according to the state of the atmosphere.

“This part of Africa generally experiences ten or twelve of these hurricanes in a year; and it is easier to describe their effects than to discover their cause. They are characterized by circumstances which deserve all the attention of philosophers.

“The sky is clear, a perfect calm has prevailed for several hours, and the weight of the air is oppressive. Suddenly, in the most elevated region of the atmosphere, is perceived a little round and white cloud, the diameter of which does not appear to exceed 5 or 6 feet: this cloud, which seems to be fixed and perfectly motionless, is the indication of a tornado.

“By degrees, and at first very gradually, the air becomes agitated, and acquires a circular motion. The leaves and plants, with which the land is always covered, rise several feet from the soil; they keep incessantly moving and revolving around the same spot.

“The negroes, who pass their lives like children, amuse themselves with this rotatory motion; they follow the turn of the agitated leaves and plants, laugh at their innocent amusement, and announce the approach of the tornado.

“The cloud, which is the indicator of this phenomenon, has now increased in size: it continues to spread, and insensibly descends to the lower region of the atmosphere; at length, it grows thick and obscure, and covers a great part of the visible horizon.

“By this time the whirlwind has increased, the vessels in the bays double their cables, or drop anchor near the shore; the tornado becomes violent and terrible; the cables often break, and the violent agitation of the ships cause them to run foul of each other.

“Many negro-huts are swept away, trees blown up by the roots; and, when these whirlwinds exert their full violence, they leave deplorable traces of their progress. These meteors happily last only a quarter of an hour, and terminate by a heavy rain.

“The maritime countries to the northward, comprised between Cape Blanco and Cape Verga, are not subject to these phenomena; it is only to the south of the latter cape, and as far as that of Palmas, that they are felt in their full violence; and they always occur at the same periods. Some topographical circumstances, peculiar to this part of Western Africa, are, doubtless, among the number of causes of these whirlwinds.

“Between the tenth and twentieth degrees of latitude North, and between the eighth degree of longitude (from Greenwich) and the Atlantic Ocean, there is no spot of ground sufficiently elevated to deserve the name of a mountain. Western Africa begins to be mountainous at Cape Verga, and it continues to rise to the summit of the chain, which bears the name of Sierra Leon: these summits may be considered as the most elevated points of this part of Africa; and its topographical configuration then presenting eminences,

nences, which form an obstacle to the course of the winds, and depths in which they may be engulfed, must contribute to produce such phenomena."

Other topographic descriptions, by M. Golberry, will be found in the following section of this work.

WINDS on the ATLANTIC ISLES.—The winds upon and near the different islands, in the Atlantic Ocean, are very variable and uncertain, especially where the land is high and irregular. In general, regular sea and land breezes alternately prevail; the sea-breeze by day, and the land-breeze by night, as the land is alternately heated and cooled; but the direction of these breezes is varied by the quality and figure of the land, and other local circumstances. If the land be very high, it generally intercepts the prevailing wind, and so affects the air as to produce, on the lee-side, either a calm, a gentle breeze in an opposite direction, or a kind of eddy, which is sometimes very troublesome to shipping. Such is the case under the western part of Madeira, and to leeward of the Canary Islands; the Grand Canary being so high as to stop the current of the N.E. wind, which prevails there; and on the eastern side there is a calm, or a gentle breeze from S.W.

The calms and eddy winds, occasioned by the figure and height of the Canaries, extend from 10 to 30 leagues beyond them to the S.W., according to the height of the respective islands. The boundary of the calms may be seen; for, within them, the water is smooth; without them is the regular undulation of the sea, caused by the general wind; and, at the edge of them, the winds, by setting in opposite directions, produce a breaking of the waves, with a foam, like the billows on a rocky shoal, just beneath the surface of the ocean.

From a consideration of the particulars now described, the cause of those copious dews which fall in the night, on the islands, &c. situated within the tropics, will be apparent. For as the great power of the sun by day causes an extraordinary evaporation of the ocean, so, in the night, the exhalation, ceasing to retain the same degree of levity acquired from the heat of the sun, becomes, by the absence of the power which produced it, so dense and heavy, as again to fall back to the earth. The air, at the same time, cooling, by the same cause, is also affected by the descending moisture, and thus acquires an additional tendency to increase the land-breeze.

According to Sir Humphry Davy's theory of mists, land and water are cooled after sun-set in a very different manner:—The impression of cooling on the land is limited to the surface, and is very slowly transmitted into the interior; whereas in water, the upper stratum, when cooled, descends, and has its place supplied by warmer water from below. The surface of the water will, therefore, in calm and clear weather, and temperatures above 45° of Fahrenheit, be warmer than the contiguous land; and, consequently, the air above the land will be cooler than that above the water. When the cold air, therefore, from the land mixes with that above the water, both of them containing their due proportion of aqueous vapour, a mist or fog must be the result.

In the **CENTRAL PART** of the **OCEAN**, between the Azores and West-India Islands, Mr. Luccock was passing homeward from Brasil, in the year 1816; and, in his 'Notes,' he says, "In this neighbourhood, about latitude 29° N. and longitude 38° W. I felt the greatest degree of cold which I ever experienced; or, to express myself more correctly, I never knew a ship's company so susceptible of the *change* of temperature as there. It was the 3d of April, 1816. We had passed the equator on the preceding 20th of March. In our run to the northward, the wind had been easterly and the weather hot. The N.E. trades were undoubtedly blowing between us and the coast of Africa, and we were now approaching their northern verge. It was, therefore, natural to suppose that we had suddenly entered into that section or current of air which had recently passed over the mountains of Atlas, probably at that early period of the year, still covered with snow. If this conjecture be right, it shows that the frosts of these African mountains produce a very sensible degree of coldness at the distance of 1300 miles from them; that the scorched desert also has warmed the atmosphere to the same extraordinary distance from the coast, and that the two lines of the aerial current have run parallel to, and almost without intermingling with, each other.

JAMAICA.—At JAMAICA the air is, in most places, hot and unfavorable to European constitutions; but the cool sea-breezes, which set in every morning, render the air more tolerable; and that upon the high grounds is temperate, pure, and cooling. It lightens

lightens almost every night, but without much thunder; nevertheless, when the latter happens, it is very terrible, and roars tremendously.

On the southern side of the island the sea-breeze from the south-eastward comes on in the morning, and gradually increases, until noon, when it is strongest: at two or three in the afternoon its force diminishes; and, in general, it entirely ceases by five o'clock. About eight in the evening the land-breeze begins: this breeze extends to the distance of 4 leagues to the southward from the island. It increases until midnight, and ceases at about four in the morning.

The sea and land-breezes are more regular than otherwise from the latter part of January until May. In the middle of May the sea-breeze generally prevails for several days and nights, especially about the time of full and change of the moon; and thus they continue throughout June and part of July; from that time the sea-breeze diminishes, varies, and veers round to S. by W. or S.S.W., with frequent calms. August, September, and October, are the hurricane months, in which there generally are strong gales of wind, with much rain.

In December, January, and February, when the north winds predominate, their force checks the sea-breeze. The southern coast is that which, of course, is least exposed to these winds, being sheltered, in a great measure, by the mountains. When combined with the land-breeze, they render the air very cold and unhealthy.

During the months of July and August, the sea-breeze about the island generally blows impetuously, and in frequent squalls. At this season, vessels bound hence to Europe would have the most advantageous passage through the Strait and Stream of Florida; but, in October, northerly winds frequently extend over all the Bahamas, Cuba, and, for some time, on the north side of Jamaica: but the current of air is forced upward by the mountains of the latter, and its strength is spent in the heights. In seasons when it is more impetuous, it rushes through the windings and defiles of the mountains upon the southern coast, particularly in the neighbourhood of Kingston, and has been known to continue for some days.

During the winter, the land-breeze is more general off the shores than in summer; it sometimes continues throughout the day as well as night, and westerly winds prevail over all the space between Jamaica and Cuba, and even to the Island of Hayti or St. Domingo. They have been experienced from Port-Royal, through the Windward Channel; but this is not generally the case.

In November, southerly winds prevail on the south side of the island, and have been known to extend from the Mosquito shore, whence vessels have arrived in five or six days, that might, at other times, have been as many weeks, when beating against the sea-breeze. The southerly winds are generally faint; nor do they come upon the land until it be heated by the sun, and are often expelled by a fresh land-breeze soon after mid-day, which abates in a few hours.

The return of the sea-breeze, falling sooner or later in autumn, is gradual; first approaching the east end, then advancing a little; and, in some years, it reaches Morant Point fourteen or twenty days before it is felt above Kingston. It also blows for a week or two later on the east end of the island than at Kingston; and has been known, in some years, to prevail there in the day-time during the whole time it was unfelt at the former place.

Notices of various other local winds, on the American Coasts, &c., may be found in the particular descriptions given hereafter.

WEST INDIES IN GENERAL.—The following description of the winds prevailing over these regions, in the different seasons, has been extracted chiefly from Captain Livingston's translation of the '*Derrotero de las Antillas*,' or Spanish Directory for the West-Indies, now included in the '*Colombian Navigator*.'

"On the Eastern coasts of America, and among its islands, the course of the general easterly or trade-wind is uninterrupted, though subject to some modifications in direction and force. At a short distance from the land, the sea-breeze calms at night, and is replaced by the land-breeze: this variation happens every day, unless a strong wind prevails from the northward or southward; the first of these being experienced from *October to May*, and the second in *July, August, and September*.

"The general easterly wind, of the tropical regions, is felt on the coast of Guyana and

and on the coasts of the Colombian and Mexican Seas, but with variations which may be denominated *diurnal* and *annual*. The diurnal period is that which the *sea-breeze* causes, and which strikes the coast usually at an angle of two points, less or more according to the locality and other circumstances; and then the *land-wind*, which, coming from the interior, always blows off shore. The sea-breeze comes on at about nine or ten in the forenoon, and continues while the sun is above the horizon, increasing its force as that luminary augments its altitude, and diminishing, in a similar proportion, as the sun's altitude decreases. Thus, when the sun is on the meridian, the sea-breeze is at the maximum of its strength; and at the time that the sun reaches the horizon, this breeze has, perceptibly, ceased. The land-breeze commences before midnight, and continues until the rising of the sun; sometimes longer. A space of some hours intervenes between the land-breeze's ceasing and the sea-breeze's coming on, during which there is a perfect calm.

"The *annual period* of the trade-wind here is produced by the proximity or distance of the sun, which occasions the only two seasons known in the tropics, the *rainy* and the *dry* seasons. The first is when the sun is in the tropic of Cancer, and heavy rains with loud thunder are prevalent. In this season the wind is generally to the southward of East, but interrupted by frequent calms, yet it occasionally blows with force and obscures the atmosphere.

"When the sun removes to the tropic of Capricorn, the dry season commences, and then the trade-wind, which is steady at N.E., is cool and agreeable. At this season, North and N.W. winds are sometimes found, blowing with much force; and, indeed, in some degree, they regularly alternate with the general wind, as they are more frequent in November and December, than in February and March.

"In the change of the seasons there is a remarkable difference: for, in April and May, no change is experienced in the atmosphere, and the weather is, in general, beautifully fine; but, in August, September, and October, there are usually calms, or very light winds; and dreadful hurricanes, in these months, sometimes render the navigation perilous. From these perils, however, are generally exempted the Island Trinidad, the coasts of Colombia, (late Terra Firma,) the Bays of Darien and Honduras, and the Bight of Vera-Cruz, which the hurricanes seldom reach. In the space of sea between the greater Antillas,* and the coast of Colombia the general N.E. or trade-wind regularly prevails; but, near the shore, local peculiarities are found:

It has been remarked, by *Captain F. Chamier*, of the British navy, that "about BARBADOES and the WINDWARD ISLANDS, from Tobago to Barbuda, the wind will be found to veer more to the northward in the early part of the year than in the months of June, July, and August. In the more northerly islands, as Dominica, Montserrat, Antigua, Nevis, &c., the wind, in the evenings of January, February, and March, veers round to about North or N.N.E.; blows very fresh in squalls; and, from the extensive space of ocean over which it travels, becomes cool and very refreshing. The thermometer, even in English Harbour, Antigua, in the above months, at eight o'clock *p.m.*, I never saw above 76°. In this season of the year, the sickness of the hot months is no longer experienced; the general lassitude of the mornings and noons of July and August seems forgotten; and no man who visited these islands during the first three months of the year, would believe that the change of 70 or 80 days could make such an amazing difference in the look, as well as in the energy, of the inhabitants of the Windward Islands. In the change of seasons, from wet to dry, a great difference is experienced in the winds. In April and May the atmosphere is, in general, clear, and fine weather prevails; but in August, September, and October, calms, or very light winds, are not uncommon, and strong hurricanes blow in these months."

"At the GREATER ANTILLAS the sea-breeze constantly prevails by day, and the land-breeze by night. These land-breezes are the freshest which are known, and assist vessels much in getting to the eastward or remounting to windward, which, without them, would be almost impossible. At the Lesser Antillas, as Dominica, Martinique, and St. Lucia, &c., there are no land-breezes."

Among the local winds are to be ranked the *Bayamos*, violent gusts which blow from

* Cuba, Jamaica, Hayti, and Porto-Rico.

the land on the south side of Cuba, and are so termed from being felt more severely off the Bight of *Bayamo* or *Buena Esperanza* than off any other part of the coast.

These squalls, which are very tremendous, have been experienced by several ships of the British navy, but particularly by the *Drake* sloop and the *Pique* frigate: the latter having lost some of her masts.

"When heavy and dense clouds gather over the mountains, a Bayamo blast may be expected; after this the surest prognostic is the thunder, which invariably precedes the gust: it is, therefore, advisable to take in all sail, with the greatest expedition, so soon as the first or most distant clap of thunder is heard, the wind following it almost immediately. Fortunately, however, these dreadful squalls are of short duration; but, as a repetition of them frequently occurs at intervals of half an hour or an hour, great attention is necessary, especially during the night, to prevent the ship's being unprepared; as it is almost certain that, if she were overtaken by one of these squalls, whilst under sail, she would either upset or lose her masts.

"These sudden tempests are attended with sheet and forked lightning, vivid in the extreme; and the flashes, following each other in quick succession, have the momentary effect of illuminating every object, and leave behind them a sort of blue indescribable appearance: the sea is whitened with foam, and the rain falls in torrents, surpassing any, perhaps, witnessed in other regions; for it appears as if the clouds had opened their store of waters to deluge the Earth: in fact, we cannot better describe the extreme heaviness of the shower, than by giving the sailor's observation on it; namely that it 'comes down by buckets full.' The Bayamo Squall, however, although the most awful of any in the Caribbean Sea, and creating much anxiety to those exposed to its fury, is grand and sublime."—*Lieut. Evans*, "Revision of Geographic Terms," p. 107.

"On the COASTS of GUYANA," the *Derrotero* again continues, "there are no land-breezes, nor more wind than is generally experienced between the tropics. In January, February, and March, the winds here blow from North to E.N.E., and the weather is clear. In April, May, and June, the winds are from East to S.E. In July, August, and September, there are calms, with tornadoes from South and S.W.; and, in October, November, and December, there are continual rains, while the sky is, in general, obscured by clouds. In the dry season, which is from January to June, the heat is very great; and, in the wet season, from August to November, rains and thunder are constant and violent.

"On the COASTS of CUMANA and CARACCAS, to Cape la Vela, the breeze follows the regular course; but from that cape to Cape San Blas the general wind alters its direction; for it blows from N.E. or N.N.E., excepting in the months of March, April, May, and June, when it comes to E.N.E., and is then so uncommonly strong as to render it necessary for vessels to lie-to. These gales, which are well known to mariners, extend from about mid-channel to within two or three leagues of the coast, where they become weak, especially at night. On this coast, about the BAY of NICARAGUA, are westerly winds, which the pilots of that country call *Vendavales*, (rainy winds,) in the months from July to December; but these winds never pass the parallel of 13° N., nor do they blow constantly, but alternate with the sea-breeze.

"Upon the MOSQUITO SHORE, HONDURAS, and EASTERN COAST of YUCATAN, the general winds or breezes prevail in February, March, April, and May; but, during the first two of these months, they are occasionally interrupted by *norths*. In June, July, and August, the winds here are from the eastward and westward of South, with tornadoes and calms. In September, October, November, December, and January, they are from the northward or southward of West, with frequent gales from W.S.W., W.N.W., and North.

"On the NORTHERN and WESTERN COASTS of YUCATAN, between Cape Catoche and Point Piedras or Desconocida, and thence to Campeché, there is no other than the N.E. or general wind, interrupted by hard norths in the season of them; and, about the end of April, tornadoes commence from N.E. to S.E. These tornadoes generally form in the afternoon, continue about an hour; and, by nightfall, the serenity of the atmosphere is re-established. The season of the tornadoes continues until September, and in all the time there are sea-breezes upon the coast, which blow from N.N.W. to N.E. It has been remarked that, as the breeze is more fresh, the more fierce is the tornado, especially from June to September. The sea-breezes come on at about eleven of the day; and at night the wind gets round to E.N.E., E.S.E., or S.E., so that it may be, in some degree, considered as a land-breeze.

"On the COAST of the MEXICAN SEA, from VERA CRUZ to TAMPICO, the breeze from E.S.E. and East prevails in April, May, June, and July; and, at night, the land-breeze comes off from South to S.W.: but if the land-breeze is from the N.W. with rain, the wind, on the day following, will be from North, N.N.E., or N.E., particularly in August and September: these winds are denominated, in the country, '*Vientos de Cabeza o Vendavales*' (head-winds or rainy winds); they are not strong, nor do they raise the sea; with them, therefore, a vessel may take an anchorage as well as with the general breeze, but they impede getting out, for which the land-breeze is required. The *Vientos de Cabeza*, or head-winds, reach to about 20 or 30 leagues from the coast, at which distance are found those at East and E.S.E.

"From the middle of September until the month of March, caution is necessary in making VERA CRUZ, for the norths are then very heavy. The narrowness of this harbour, the obstruction formed by the shoals at its entrance, and the slender shelter it affords from the norths, render an attempt to make it, during one of them, extremely dangerous, for it will be impossible to take the anchorage. The following description of the winds here has been written by Don Bernardo de Orta, a captain in the Spanish navy, who has been captain of the port, and who surveyed it.

"Although in the Mexican Sea it cannot be said that there is any other constant wind than the general breeze of this region, yet, from September to March the north winds interrupt the general course, and, in some degree, divide the year into two seasons, *wet* and *dry*, or of the *Breezes* and *Norths*: the first, in which the breezes are settled, is from March to September: and the second, in which the norths blow, is from September to March. For greater clearness we shall explain each separately.

"The first of the Norths is regularly felt in the month of September; but, in this month and the following one, October, the Norths do not blow with much force. Sometimes it happens that they do not appear; but, in that case, the breeze is interrupted by heavy rains and tornadoes. In November the Norths are established, blow with much strength, and continue a length of time during December, January, and February. In these months, after they begin, they increase fast; and in four hours, or a little more, attain their utmost strength, with which they continue blowing for forty-eight hours; but afterward, though they do not cease for some days, they are moderate. In these months the Norths are obscure and north-westerly, and they come on so frequently, that there is, in general, not more than four or six days between them. In March and April they are neither so frequent, nor last so long, and are clearer, but yet they are more fierce for the first twenty-four hours, and have less north-westing. In the interval before November, in which, as we have said, the *Norths* are established, the weather is beautiful, and the general breeze blows with great regularity by day; the land-breeze as regularly by night.

"There are various signs by which the coming on of a *North* may be foreseen: such are, the wind steady at South; the moisture of the walls, and of the pavements of the houses and streets; seeing clearly the Peak of Orizaba and the Mountains of Perote and Villa-Rica, with the cloud on those of St. Martin, having folds like a white sheet; the increase of heat and of dew; and a thick fog, or low scud, flying with velocity to the southward: but the most certain of all is the barometer; for this instrument, in the time of the Norths at Vera-Cruz, does not vary more, between its highest and lowest range, than $\frac{8}{10}$; that is to say, it does not rise higher than 30 inches $\frac{8}{10}$, nor fall lower than 29 inches $\frac{8}{10}$. The descent of the mercury predicts the Norths; but they do not begin to blow the moment it sinks, which it always does a short time before the North comes on: at these times lightnings appear on the horizon, especially from N.W. to N.E.; the sea sparkles; cobwebs are seen on the rigging, if by day: with such warnings trust not to the weather, for a North will infallibly come on.

"This wind generally moderates at the setting of the sun; that is, it does not retain the same strength which it had from nine in the morning to three in the afternoon, unless it commence in the evening or at night, for then it may increase otherwise. Sometimes it happens that, after dark, or a little before midnight, it is found to be the land-wind, from the northward and westward; in which case, should it get round to the southward of west, the north will be at an end, and the general breeze will, to a certainty, come on at its regular hour: but, if that does not happen at the rising of the sun, or afterward, and at the turn of the tide, it will return to blow from the north, with the same violence as on the day before, and then it is called a *Norte de Murea*, or *Tide-North*.

"The Norths also sometimes conclude by taking to the northward and eastward, which is more certain; for if the wind in the evening gets to N.E., although the sky remain covered the day following, but by night the land-breeze has been from the northward and westward, the regular breeze will surely ensue in the evening, good weather succeeding and continuing for four or six days; the latter period being the longest that it will last to, in the season of the norths: but, if the wind retrograde from N.E. to N.N.E. or North, the weather will be still unsettled.

"Examples are not wanting of Norths happening in May, June, July, and August, at which times they are most furious, and are called *Nortes del Hueso Colorado*; the more moderate are called *Chocolateros*, but these are rather uncommon.*

"The Wet Season, or Season of the Breezes, is from March to September: the Breezes, at the end of March and through the whole month of April, as already explained, are, from time to time, interrupted by Norths, and are from E.S.E. very fresh; the sky sometimes clear, at other times obscure. At times these touch from S.E., and continue all night, without giving place to the land-breeze, which prevails, in general, every night, excepting when the north wind is on. The land-breeze is freshest when the rains have begun.

"After the sun passes the zenith of Vera-Cruz, and until he returns to it, that is, from the 16th of May to the 27th of July, the breezes are of the lightest description; almost calms, with much mist or haze, and slight tornadoes. After that time, the pleasant breezes from N.W. to N.E. sometimes remain fixed.

"From the 27th of July to the middle of October, when the Norths become established, the tornadoes are fierce, with heavy rains, thunder, and lightning: those which bring the heaviest winds are from the east, but they are also those of the shortest duration.

"In the season of the Breezes, the total variation of the barometer is $\frac{4}{10}$; the greatest ascent of the mercury is to 30 inches $\frac{36}{100}$, and its greatest descent to 29 inches $\frac{36}{100}$. The thermometer in July rises to 87° , and does not fall to $83\frac{1}{2}^{\circ}$: in December it rises to $80\frac{1}{2}^{\circ}$, but never falls below $66\frac{1}{2}^{\circ}$. This, it must be understood, was ascertained in the shade, the instrument being placed in one of the coolest and best ventilated halls in the castle.

"In the months of August and September, rarely a year passes without hurricanes near Florida and the northern Antillas; but to Vera Cruz, or any part of the coast thence to Campeché, they never arrive; all that is felt being the heavy sea, which has arisen in the higher latitudes. Hurricanes begin to the northward and eastward; and although they

* From Lient. *John Evans* (a), R.N., (a gentleman to whom we are indebted for many valuable communications,) we have received the following description of a *North* in the Mexican Sea, which occurred in March, 1828.

"We had observed, during our run over the Catoche Bank, a very extraordinary white hazy-like appearance, very distinct from the common fog, haze, or mist; this was seen principally in the northern quarter, and attracted much notice; the air, at the same time, 'breathing gently at south,' and the sympiesometer falling unusually low, gave us strong indications of an approaching *North*. On the 15th there appeared on the sky only a few small *cumuli* and dark *strati*; in the morning the air was very light from the south, and was so warm, or rather hot, and oppressive, that, like the *sirocco*, it affected the breathing of some of us. At 10 a.m. it changed to the N.E. with fine weather, the wind gradually freshening; at sun-set the *cumuli* changed into dark *nimbus*, of a deep purple, edged with a bronze colour; from these clouds proceeded squalls with rain, the wind veering from N.E. to N.N.W., after which it cleared up, the clouds all dispersed, and at 8 p.m. a fresh North came on, with a very rapidly rising sea (which a short time before had been perfectly calm and smooth). The sympiesometer fell to 29-80, which was lower than it had ever done before.

"It blew a gale all night, with a heavy sea; no clouds; the stars bright and large. The same white hazy-like appearance took place before the North set in. Early in the morning of the 16th, the wind died away suddenly, almost to a calm; and at 8 a.m. became a moderate breeze."

In describing his voyage to Tampico, in 1825, Mr. *Beaufoy* makes the following remarks on the exhalation and climate of the Mexican Sea:—"The dew which fell from a clear blue star-light sky, not only wetted the deck and rigging, but penetrated through a thick great coat; and the scorching heat of the sun only rendered the dampness of the shade more uncomfortable, though the thermometer stood at 86 degrees.

"A storm of thunder and lightning, but without rain, such as I had never before witnessed, gratified not a little my expectations of the marvellous: crash followed crash, or murmured slowly along amid the airy mountains which bounded the horizon; while balls of fire burst-like volcanoes among the heavy masses, seeming to threaten destruction to earth and heaven."

do not always go round the same way, yet, in general, they next go to the southward and eastward, with thick squally weather and rain."

From TAMPICO to the BAY of SAN BERNARDO, breezes, from the southward and eastward, are steady and pleasant from April to August; but, in the remaining months, this coast is much exposed to gales from East and E.S.E., which blow without intermission, for two or three days, before a North comes on. In about latitude $26\frac{1}{2}^{\circ}$, there are land-breezes in the summer, which blow from midnight until nine in the forenoon.

From the Bay of SAN BERNARDO to the MISSISSIPI there are land-breezes (*Madrugada*) in the early part of the morning, but after day-light the wind comes to S.E. or E.S.E., and generally in the evening it is from the S.W. In winter the south winds are most stormy, and blow for two or three days together. The most dangerous months for navigating these seas are August, September, October, and November, in which there are hurricanes and traverse winds, (winds blowing dead on shore,) which are so heavy, that a vessel under them cannot carry sail. Upon the Missisipi, and all about its entrance, fogs are thick and frequent; particularly in February, March, and April.

From the Missisipi to the parallel of 28° , the breezes from the northward and eastward, or southward and eastward, prevail in the mornings of the months from April to July, and in the afternoon the wind changes to S.W. These are called the '*Virazonos*,' or *Turnings*. There are storms in August, September, and October, the season in which also are the strongest souths and hurricanes. From November to March, the Norths prevail: they begin at S.E. and South, with much rain, pass to S.W. and West, whence they blow with much force, and remain until they chop round to N.W. and North, after which the weather becomes serene.

From the Gulf, in the parallel of 28° , to the Eastern Kays of Florida, the breezes or general winds prevail until mid-day, when the sea-breeze sets in during the summer; but, in the winter, and especially from November till March, the winds are from the southward and eastward, and raise much sea.

In the Strait of Florida, the breezes are the prevailing winds, but they are interrupted by Norths in the winter, and by calms in summer. Although the northern limit of this channel is within the boundary of the breezes, or trade-wind, it is necessary to remember that, in winter, or from November to April, the variable winds from the southward and eastward, and southward and westward, are met with in latitude 27° , and even before: and, in summer, from May until September, the winds in the whole channel are variable from the southward and eastward and southward and westward.

Mr. Henry Davy, in his description of the passage of H.M.S. *Cornwallis*, from the West-Indies, in the winter of 1837, says that "The wind, during our progress through the Gulf Stream, veered in circles in a most extraordinary manner. The gale blowing from West to N.N.W., ceased at North; it then veered to N.E. and East, with fine weather; blew strong at S.E., South, and S.W., and commenced another gale as the wind completed its circle to the northward.* Though the heavy seas and swell were from the direction of the gales, yet a considerable sea gets up from any point where the wind makes a stand during its progress round. This causes a confused cross swell, which I think sufficiently accounts for the sea going down so soon after the gale has subsided."—*Colombian Navigator*, vol. iii. p. 40, 41.

NORTH-AMERICA.—WINDS ON THE NORTH-AMERICAN COASTS.—To the southward of Newfoundland, shifts of wind are very common, and it frequently happens that, after blowing a gale upon one point of the compass, the wind suddenly shifts to the opposite point, and blows equally strong. It has been known that, while one vessel has been lying-to, in a heavy gale of wind, another, not more than 30 leagues distant, has, at the very same time been in another gale, equally heavy, and lying-to, with the wind in quite an opposite direction.†

* This, it may be observed, makes the complete circle according to the motion of the sun or hands of a watch, and contrary to the general motion of hurricanes on the Atlantic, as hereafter described.—ED.

† Mr. Redfield has shown that this statement is to be understood as applicable to two vessels falling under the two opposite sides or portions of the same storm, where the wind, in its circuit of rotation, must blow from opposite quarters of the horizon, as explained hereafter.

In the year 1782, at the time the *Ville de Paris*, *Centaur*, *Ramillies*, and several other ships of war, either foundered, or were rendered unserviceable, on or near the Banks, together with a whole fleet of West-Indiamen, excepting five or six, they were all lying-to, with a tremendous gale from E.S.E. or S.E. by E., which thus continued until at last it shifted suddenly into a violent squall from N.N.W., or more westerly, and every ship lying-to, under a square course, foundered.*

The winds within the Gulf are not so liable to sudden shifts as on the outside, or to the eastward, of Breton Island. The weather to the southward of the *Magdalen Islands*, between them and Prince Edward Island, is generally much clearer than on the north.

GULF AND RIVER OF ST. LAWRENCE.—Captain Bayfield states that, during the navigable season, the prevailing winds are either directly up or directly down the Estuary of St. Lawrence, following the course of the chains of high lands on either side of the great valley of the river. Thus a S.E. wind in the Gulf becomes E.S.E. between Anticosti and the south coast, E.N.E. above Point des Monts, and N.E. above Green Island. The westerly winds do not appear to be so much guided in direction by the high lands, excepting along the south coast, where a W.S.W. wind at the isle Bic has been seen to become West, W.N.W. and N.W., on running down along the high and curved south coast, until it became a N.N.W. wind at Cape Gaspé. These winds frequently blow strong for three or four days in succession; the westerly winds being almost always accompanied with fine dry, clear, and sunny weather; the easterly winds as frequently with the contrary, cold, wet, and foggy. In the spring the easterly winds prevail most; frequently blowing for several weeks in succession. As the summer advances the westerly winds become more frequent, and the S.W. wind may be said to be the prevailing wind in summer in all parts of the river and gulf. Light south winds take place occasionally; but north winds are not common in summer, although they sometimes occur. Steady north winds do not blow frequently before September, excepting for a few hours at a time, when they generally succeed easterly winds which have died away to a calm, forming the commencement of strong winds, and usually veering to the S.W. The N.W. wind is dry, with bright clear sky, flying clouds, and showers. After the autumnal equinox, winds to the northward of west become more common, and are then often strong steady winds of considerable duration. In the months of October and November the N.W. wind frequently blows with great violence, in heavy squalls, with passing showers of hail and snow, and attended with sharp frost.

Thunder storms are not uncommon in July and August; they seldom last above an hour or two, but the wind proceeding from them is, in general, violent and sudden, particularly when near the mountainous part of the coast; sail should, therefore, be fully and quickly reduced on their approach.

Strong winds seldom veer from one quarter of the compass to another directly or nearly contrary; in general they die away by degrees to a calm, and are succeeded by a wind in the opposite direction. It is not here meant that they may not veer to the amount of several points. N.W. winds seldom or never veer round by North and N.E. to East and S.E., but they do frequently, by degrees, to the S.W., after becoming moderate. S.W. winds seldom veer by the N.W. and North to the eastward, but sometimes by the South to

* In the journal of an officer of H.M.S. *Ramillies*, Sept. 16, 1782, it is stated, "At noon, lat. 42° 15', long. 48° 55', wind at E.S.E. blowing fresh; at one p.m. gale increased, hazy weather; at 3 took in sails; at 6 p.m. gale very strong; brought to under the main-sail. Midnight 3½ feet water in the hold; gale E.S.E. exceedingly strong; at 2 a.m. on the 17th, heavy rain and squally; at 3 a.m. the wind shifted; a violent squall from the N.N.W., without the smallest warning of a shift, took the mainsail aback; the main-mast, mizen-mast, fore-topmast, and fore-yard, carried over the ship's side, and the tiller broke; water, 4 feet 4 inches, and gaining on us; at day-light, 5 feet 8 inches, and gaining, ship labouring in great distress; at 5 a.m. one of the convoy foundered close to us; several near us dismasted, and signals of distress making from all: a prodigious swell of the sea, and heavy gale from N.W.; at 10 a.m. hard gale from N.W. and prodigious swell; 6 feet water in the hold; afternoon threw guns overboard, &c." (Quoted by Mr. Redfield.)

The *Ramillies*, of 74 guns, bearing the flag of Rear-Admiral T. Graves, was, with other ships of the line and convoy, on her passage from Jamaica toward England, and, having been rendered unserviceable by the weather, was burnt on the Banks of Newfoundland, Sept. 21. From the same reason the *Hector*, 74, Capt. Bouchier, was sunk on the Banks, October 5. The *Centaur*, 74, Capt. Inglefield, foundered in the Ocean, and only 12 persons were saved; and the *Glorieux*, 74, is supposed to have foundered, having never since been heard of.

S.E. and East. Easterly winds generally decrease to a calm, and are succeeded by a wind from the opposite direction.

In the fine weather westerly winds of summer a fresh top-gallant breeze will often decrease to a light breeze or calm at night, and spring up again from the same quarter on the following morning: under these circumstances only may a land breeze off the north coast be called for. The same has been observed off the south coast also, but not so decidedly, nor extending so far off shore. Captain Bayfield adds, "I have occasionally carried the north land-wind nearly over to the south coast just before day-light, but have never observed the south land-wind extend more than five or six miles off, and that very rarely. Under the same circumstances, that is with a fine weather-westerly wind going down with the sun, a S.W. land breeze will frequently be found blowing off the north coast of Anticosti at night and during the early part of the morning. If, however, the weather be not settled fair, and the wind does not fall with the sun, it will usually prove worse than useless to run a vessel close in shore at night in the hope of a breeze off the land. Such is the usual course of the winds in common seasons, in which a very heavy gale of wind will probably not be experienced from May to October, although close reefed top-sail breezes are usually common enough. Occasionally, however, there are years, the character of which is decidedly stormy. Gales of wind, of considerable strength, then follow each other in quick succession, and from opposite quarters. The marine barometer, which is at all times of great use to the navigator, becomes particularly so in such seasons, as shown in the *Appendix* hereafter.

UNITED STATES.—WINDS ON THE COAST OF SOUTH-CAROLINA, &c.—Remarks by Mr. Geo. Walker.—About this coast, if the wind blows hard from the N.E. quarter, without rain, it commonly continues so for some time, perhaps three or four days; but, if such winds are attended with rain, they generally shift to the E., E.S.E., and S.E. South-east winds blow right in on the coast; but they seldom blow dry, or continue long: in 6, 8, or 10, hours after their commencement, the sky begins to look dirty, which soon produces rain. When it comes to blow and rain very hard, you may be sure the wind will fly round to the north-west quarter, and blow hard for twenty or thirty hours, with a clear sky.

North-west winds are always attended with clear weather; they sometimes blow very hard, but seldom for longer than thirty hours. The most lasting winds are those which blow from the S.S.W. and W.N.W., and from the North to the E.N.E. The weather is most settled when the wind is in any of these quarters.

In summer time, thunder-gusts are very common on this coast; they always come from the north-west quarter, and are sometimes so heavy, that no canvas can withstand their fury: they come on so suddenly, that the greatest precaution is necessary, to guard against the effects of their violence.

Of the thunder-gusts, Captain Walker has said: The first indication of them is a black heavy cloud, the weather sultry, little wind, and variable. I advise, at the appearance of these warnings, not to stay to reef, but clue up every sail, except the fore-sail and fore top-mast stay-sail, and your ship will be ready to veer; if you have time to hand the sails clued up, do it, but it seldom happens that you have, as these gales come on suddenly. A shocking accident happened to a brigantine in company with me, off Cape Hatteras, in the year 1773; a little before the squall reached them, they attempted to reef, and, in the time of reefing, the vessel overset, and all perished.

The same gentleman, in his description of the coast in the vicinity of St. Augustin, has stated: From the 1st of November to the last of February, the hardest gales prevail that blow on this coast; and in general from the N.N.E. to the S.S.E., the wind any way easterly comes on very suddenly to a gale during the season above mentioned; and these gales give but very little warning. In the year 1777, I had the charge of His Majesty's ship, the *Lively*, and was then at anchor in St. Augustin's Bay, when it came on to blow at E.N.E., and in fifteen minutes time I was obliged to slip, and, had we not carried sail to the utmost, we should not have cleared the land to the southward.

When the wind backs against the sun, with a small rain, you will perceive the sea to rise before the wind comes; then prepare for a gale, which, in general, will last 50 or 60 hours. If you should be obliged to cut or slip, carry all the sail you possibly can, to get an offing before it increases, so as to put you past carrying any sail, which is always the case; and observe that, the flood-tide setting to the southward will be of no service to you farther out than in 12 fathoms of water, when you will be in the southern current until you get into

46 fathoms, which is about 15 leagues from the land. Then you will be in the Gulf-Stream, issuing out of the Strait of Florida, and which runs strongly all along the edge of soundings.*

To the preceding description of the winds on the American Coasts may be added the incidental Remarks of *Captain Hare*, given in the Directions for '*Passages to North America*,' hereafter. The latter, founded on actual experience, tend to show that the north-west and westerly gales commence in the southern regions before they are felt in those more northerly; and that, therefore, a northern route is, in certain cases, preferable to one more direct or southerly.

On the NORTH-EAST STORMS of North America, *Dr. Franklin* made some remarks in 1760, in which he gives his reasons for thinking that they begin first, in point of time, in the S.W. parts; that is to say, the air in Georgia begins to move south-westerly before the air of Carolina, which is the next state north-eastward: the air of Carolina has the same motion before the air of Virginia, which lies still more north-eastward; and so on north-easterly through Pennsylvania, New York, New Hampshire, &c. quite to Newfoundland. These N.E. storms, he adds, are generally very violent, continue sometimes two or three days, and often do considerable damage in the harbours along the coast. They are attended by thick clouds and rain.

The Doctor illustrates his hypothesis with his usual felicity; and concludes with saying, "Thus, to produce our N.E. storms I suppose some great heat and rarefaction of the air in or about the Gulf of Mexico; the air thence rising has its place supplied by the next more northern, cooler, and therefore denser and heavier, air; that, being in motion, is followed by the next more northern air, &c. &c. in a successive current; to which current our coast and inland ridge of mountains give the direction of N.E., as they lie N.E. and S.W." —See *Works*, Vol. II., page 63; Edition of 1809.

Col. Reid says, "At New York the labouring people remark that, if the haze indicating a storm be first seen over Staten Island (on the S.W.) the wind will come from the N.E.; but if the haze be seen first over the Jersey shore of Hudson River (or westward) then the wind will come on from the S.E. It is also said to be a seaman's phrase that a *north-wester* will never remain long in debt to a *south-easter*;" and these observations are supported by experience.

It has been remarked that, at the same place, "In four successive years the westerly winds have been found to be to the easterly nearly as two to one. Observations on the courses of the clouds for the same period, show the prevalence of an atmospheric current from the westward, at that elevation to be, as compared with those from the eastward, nearly as fourteen to one; the prevailing wind being south-westerly. At Montreal, in Canada, as appears by the observations of J. Mc'Cord, Esq. the westerly surface winds also appear to exceed the easterly, in the proportion of more than four to one." Hence it is that the passages of the fastest ships, from Europe to America, are found to occupy a much longer period than from America to Europe.†

PROGRESSIVE WINDS, when they have an opposite wind to subdue, are frequently preceded many hours by a swell, which extends a great way before them.

BERMUDAS' ISLES.—Near these islands, as shown hereafter, storms are very frequent; but the prevailing winds, with fine weather, are from between the south and west. Hakluyt, in his *Voyages*, 1598, calls the sea about the Bermudas a "hellish place for thunder, lightning, and storms;" and another writer, in 1615, describing the arrival of the English at these islands in 1609, has said, "Sir George Somers, sitting at the sterne, seeing the ship desperate of relief, looking every minute when it would sinke, he espied land, which, according to his and Captain Newport's opinion shou'd be that dreadful coast of the *Bermodes*, which islands were, of all nations, said and supposed to be enchanted, and inhabited with witches and devils; which grew by reason of accustomed monstrous thunder, storme, and tempest, neere unto those islands; also for that the whole coast is so wondrous dangerous of rockes, that few can approach them but with unspeakable hazard of shipwreck." We now laugh at this: knowing that the mild and regular climate of these islands is noted

* Directions for proceeding to and from the Ports of America with adverse winds, will be found in the Directions for making the Passages, hereafter.

† "Meteorological Sketches by an Observer;" American Journal of Science and Arts, vol. xxxiii. for

for the purity of its air, together with the abundance and quality of fruits and vegetables, although too frequently within the circuit of the hurricanes,* as shown in our third section.

A most violent storm visited the Bermuda Islands on the 11th of November, or December, 1839, which greatly damaged the houses of the towns Hamilton and St. George's, and destroyed large numbers of cedar trees in every part of the island. The gale was accompanied with most violent torrents of rain, and the gusts of wind caused the waves of the ocean to cast showers of sea water far over the land, so that many of the tanks of drinking water throughout the country became brackish, and various kinds of fish were found on land, hundreds of yards from the shore.

Considerable damage was done to smaller vessels belonging to the islands; several were driven ashore and wrecked.—*Hamilton Bermudian*, &c.

OF HURRICANES IN GENERAL.

A HURRICANE is a tempest of the most extraordinary violence, forming a kind of imperfect vortex, around the centre of which the wind proceeds, successively and abruptly, from different points of the horizon. Of such phenomena, the most violent and destructive, in the western hemisphere, are known to originate in or near the West Indies: and they commonly proceed, in a cycloidal line, from their point of origin, to the W.N.W., N.W., North, and N.E.; or, if limited to the West-Indian Sea, from E.S.E. to W.N.W.

Hurricanes, as already noticed, appear to be caused by sudden changes both in the upper and lower regions of the atmosphere; as, when the lower regions are highly rarefied, and the upper equally condensed, the one descends with violence into the other, and re-action instantly commences.†

In the month of August, 1827, the American coasts and nearly all the West Indies were visited by violent hurricanes. In the West Indies they were said to be most dreadful. On the 18th, 19th, and 20th of August, they caused great ravages at Antigua, St. Christopher's, Barbadoes, Hayti, Jamaica, &c. At the city of St. Domingo they commenced on Saturday, August 18th, from the S.E., and terminated with the wind from S.S.W. All the mahogany on the coast was carried to sea, and most of the vessels in the harbour were driven on shore. Those at anchor in the mouth of the harbour got under way at the commencement of the gale, put to sea, and were all wrecked.

The tail of the hurricane was over Port-au-Prince from 3 p.m. till about 3 a.m. (18th and 19th). It came from the N.E., threw the shipping into some confusion, but did them no serious damage, though the plains and ridge of mountains were almost laid waste.

These hurricanes caught the ship *Salacia*, on the 24th of August, without the Florida Stream, in lat. $32^{\circ} 30'$, long. $73^{\circ} 48'$, when she drifted W.N.W. to lat. $32^{\circ} 50'$, long. $74^{\circ} 40'$. A second hurricane attacked her on the 7th of September. It blew furiously on the 8th and 9th, when the deck was swept by the sea, and several persons washed overboard. On the 10th she was totally dismasted, and on the 11th experienced another heavy gale.

In the hurricanes of the early part of the following year, 1828, H.M. sloop the *Acorn*, of 18 guns, with the *Contest*, gun-brig, of 12, and the *Sappho*, of 18, were lost, with every soul on board, between the Bermudas and Halifax. The *Tyne*, 28, in company, weathered the storm.

H.M. brig, *Beaver*, Capt. T. Edwards, arrived at Falmouth from Jamaica and Crooked Islands, on the 16th of January, 1828. For the last three weeks the *Beaver* had experi-

* See Capper on Winds and Monsoons, page 177.

† "There seems to be a region higher in the air over all countries, where it is always winter, where frost exists continually, since in the midst of summer, on the surface of the earth, ice falls often from above in the form of hail.

"Hailstones, of the great weight we sometimes find them, did not probably acquire their magnitude before they began to descend. The air, being 800 times rarer than water, is unable to support it but in the shape of vapour, a state in which its particles are separated. As soon as they are condensed by the cold of the upper region, so as to form a drop, that drop begins to fall. If it freezes into a grain of ice, that ice descends. In descending, both the drop of water and the grain of ice are augmented by particles of the vapour they pass through in falling, and which they condense by coldness, and attach to themselves."—*Franklin*, vol. ii. p. 66.

enced very severe gales from the westward ; and so heavy was the sea, that, on two occasions she was nearly going down, and was obliged to throw her guns overboard ; the boats were washed from the quarters, and her upper works stove in.

This weather reached Plymouth Sound, on Sunday, January the 13th ; for shortly after midnight a violent hurricane came on from the S.W., accompanied with vivid flashes of lightning, much rain and thunder. The greatest alarm and confusion prevailed, as the harbour and sound were crowded with shipping. When day broke there were, altogether, thirteen vessels on shore ; six in Deadman's Bay, six in Mount Batten Bay, and one in Bovisand Bay. Eight ships, however, rode it out in the Sound without damage. On shore the destruction of chimneys and roofs of houses was very extensive ; and altogether, says the describer, this hurricane is a visitation that will long be remembered.

The hurricane, however, did not extend in its violence and ravages, in any considerable degree, to the neighbourhood of Portsmouth ; but a striking proof of the effect of the storm was exhibited in the return of the free-trader *General Palmer*, Captain Truscott (R.N.) which ship had left St. Helen's on Saturday morning, on her passage to Madras and Bengal, which she had done several times before, performing the voyage in remarkably short periods of time. The wind was from the southward and eastward ; she made a good offing ; but, after night-fall, the wind constantly headed her and freshened, which circumstances kept Captain Truscott and the whole crew on deck during the night, shortening sail and making the ship snug, and every thing secure. At 6 a.m. on Sunday, when at about 15 miles off Portland, the ship was wore, laid with her head off the land, and scarcely brought to the wind on the starboard tack, when a sudden gust or squall carried away her three masts at the same instant, about two feet above the deck. The ship, from the heavy sea running, shipped a quantity of water and laboured much, but, from the previous precautionary means which had been taken, this did not injure the hull ; the wreck was cleared as soon as possible, and upon a boat's mast a small sail was hoisted, by which she was got before the wind ; fortunately she made Dunnose in the afternoon, and anchored at St. Helen's about sun-set.

HURRICANES IN THE WEST-INDIES.

The HURRICANES of the *West Indies* are to be expected in the months of August, September, and October, but they sometimes occur as early as June and July. These dreadful tempests in an instant, at times, spread destruction around, and render it impossible to set any sail whatever, scarcely giving time to secure the masts and hatchways before it reaches its meridian violence. The following description of a ship in a hurricane is a real fact, which happened at Jamaica many years ago, and ought to be a warning to commanders in preparation for so dreadful a situation.

This ship, of the Royal Navy, was lying in Bluefields, on the S.W. side of Jamaica, with one-third of a cable on the small bower, with top-gallant yards across, between the hours of three and four p.m., when it came on to blow, and gradually increased till six, when it blew very hard. The steps which were now taken were somewhat singular, and such, perhaps, as a seaman would little think of. In place of the necessary preparations for blowing weather, and giving the ship more cable, another anchor was let go under foot (top-gallant yards still across). At seven she parted the small bower, took the best on her shoulder, and drove off the bank. Now, getting down top-gallant yards was thought of, and performed with hazard and difficulty ; the ship lying along in such a manner that the main-deck guns touched the water ; the top-gallant masts were attempted to be struck, but too late, the gale raging now so violently that no man could go aloft ; the best bower was hove up, but, not being able to secure it, the cable was soon cut, and anchor let go. All the necessaries for battening down the hatches were to look for ; the gratings were, however, after much trouble, mustered from the different parts of the ship, and the hatches battened down. But this essential piece of service was neglected so long, that it now required unceasing efforts at the pumps to free the ship from the water she had taken in through the hatchways. She was now nearly on her beam-ends, while the astonishing violence of the wind, at the time, almost rendered ineffectual the exertions of the carpenters and seamen, who had to contend with the wrappings of the elements, heightened by the surrounding horrors of rocks and shoals, and a night as dark as Erebus.

The hurricane was now, beyond description, dreadful. Its action was like that of fire : every thing disappeared that opposed it ; notwithstanding the size and solidity of the masts, powerfully

powerfully supported by the shrouds, they were no longer able to resist its unremitting fury; the mizen-mast went first; in about three minutes after, the main-mast followed; and, instantly after, went the fore-mast and bowsprit. This most dreadful situation is, to the seaman's imagination, more easily pictured than described; terror and astonishment, for a moment, occupied every mind; but this inactive stupidity was soon removed by that intrepid boldness and indifference to danger, so eminently the characteristic of British seamen, and the wreck cleared with wonderful alacrity. About this time the wind chopped round to the southward, and raised a tremendous sea; by which the tiller was carried away, but soon replaced. The ship continued to drift all night, with the pumps going incessantly; at day-break, the land was seen under the lee, about two miles distant; high steep rocks, the aspect more than any thing dreadful; hardly a hope remained of saving the ship; the wind, though somewhat abated, blew with great violence dead on shore; the fore-mast, on which was hoisted a mizen top-sail, was about 12 feet above deck; the stumps of the main and mizen-masts were nearly of the same height: upon these the people were employed, getting sails set, when the wind providentially shifted to east, which, co-operating with a rapid current, enabled the ship of the rocks, which she passed at the distance of about two cables' length.

Let us now examine whether the dreadful effects of this tremendous hurricane might not have been lessened by precautions, particularly as the gale came on gradually.

In the first place, the top-gallant yards should have been got down, and the masts struck, when the gale was found to increase, or even before, as the event, at this season, might be expected; the top-sail yard should have been sent down on deck, and the top-masts lowered close down, and their heels secured; the rigging made snug in the tops, the sprit-sail-yard and jib-boom in, the cross-jack and mizen-yards lowered down, down-haul tackles fixed to the fore and main-yards, to get them down and secure them to the gunwale; the shrouds well swifted, the booms and boats well frapped, the hatchways secured, the lower-deck guns double-breeched, lowered, and muzzle-lashed; the spare tiller at hand, and relieving-tackles in the gun-room; the forelocks of the main-deck, quarter-deck, and fore-castle, guns loosed ready, in case it should be necessary to heave them overboard, as was the case of H.M.S. *Hector*, in the year 1780, in a similar hurricane.

Had the above precautions been taken, it is reasonable to suppose that the danger would have been less imminent, and that confusion prevented, which must ensue when every thing is to be done at once.*

From the investigations which have been lately made, the operation of these storms appears to be analogous to that which takes place in the common whirlwind,—a wind gyrating around a centre; it has been ascertained that the direction of the revolving current in the northern hemisphere is from right to left, past the north, or against the sun; and it seems that this is almost invariably the case in the Atlantic Ocean.†

It follows, therefore, that, from simply knowing that the wind gyrates around a centre, as above mentioned, we deduce the important fact that, by placing a ship in a certain position, according to the direction of the *first* shift of wind experienced in a hurricane, she

* A hurricane experienced on the 29th of July, 1805, by H.M.S. *Centaur*, Captain H. Whitby, has been described as follows, by Lieut. Evans, in his "*Revision of Geographic and Hydrographic Terms*, &c. 1824, pp. 116, 117. (To this gentleman we owe much information on the present subject, as shown hereafter.)

"On the 29th of July the ship was in latitude $26^{\circ} 17'$, and long. $57^{\circ} 42'$; Barbadoes bearing W. 8° S. 262 leagues. Wind from E.N.E. to S.S.W.

"On the 27th and 28th the wind was variable; on the first of those days squally; on the latter, moderate and cloudy. At 6 p.m., on the 29th, the breeze freshened, and gradually increased to a hurricane, which lasted till day-light of the 30th; during which time the ship was in a most perilous situation, having lost her main and mizen masts, fore top-mast, &c., and making 8 feet of water an hour. It is impossible for language to describe the force with which the wind blew, the high and breaking seas that washed over the ship, or the gloomy and awful state of the weather on this occasion: the most ingenious effort of the pencil, and the most forcible language of description, must alike fall very far short of conveying to the mind an adequate idea of this storm. The ship was saved, under Providence, by the physical strength of the fine company of marines that were on board, by the superior skill of the captain, and the exertions of the other officers and men. The wind ultimately settled in the S.W. quarter, and the ship was towed, in her shattered condition, to Halifax, N.S., by H.M.S. *Eagle*, Captain Colby."

† The whirlwind described by Mr. Davy, of the *Cornwallis*, (page 109,) seems to be an exception to the general system, and is, therefore, the more worthy of notice.

will be enabled to avoid, with a prospect of success, the centre of rotation, where the greatest danger is to be apprehended.

In the inter-tropical seas the most general path pursued by hurricanes is to the N.W. curving to the North in about the 30th degree of latitude, when their course becomes North-easterly (in the direction of the Gulf-Stream), and, as they sweep along the higher latitudes, the direction of their progression becomes more easterly still. Some have, however, pursued a more westerly course.

The diameter (and consequently the circumference) of hurricanes varies, and it appears that a dilatation generally takes place as the storm progresses. It is probable that, as the circle becomes more and more enlarged, the power of the wind gradually lessens, until the energy of the action is entirely lost. Some hurricanes, whilst raging with great violence, are of immense extent, while others appear to be merely local disruptions. Of the latter class was that which passed over Antigua, in August, 1835, as hereafter described.

The main object of the navigator, when assailed by a hurricane, should be to keep his vessel *clear of the centre of rotation*, as there the strength of the wind concentrates, sudden shifts take place, and heavy and confused seas break. It is obvious that, the nearer the vortex is approached, the quicker the shifts of wind will be, and *vice versa*.

Lieut. Evans remarks that, "When fairly under the dominion or power of the storm, and in any part of the area, except in the immediate vicinage of the centre of rotation, a ship will not be liable to be taken aback; because, if scudding, she would not intersect the wind; and if she be lying-to, it will either break her off, or draw aft gradually, according to the tack she is on: but the case may be different under certain circumstances. Most ships are dismasted at the *crisis*; that is to say, at the time the wind *blows strongest*, which is always on the nearest approach from the centre to any given position. The point at which the wind of the hurricane *commences*, if observed, will make known, to the observer, the verge under which he is placed.

"Although," adds *Lieut. Evans*, "it is true that the prognostics of a coming storm are, in general, sufficiently plain to be understood by a spectator, from the angry appearance of the firmament, yet it is also true that there is no particular indication in any one quarter of the horizon sufficiently marked, like the space occupied by the *Black squall* panoply of the Caribbean Sea;—so that an acute seaman shall say—'thence will the blast come.' On the contrary, the clouds gather together (we speak from experience) in dense masses, of a cinereous hue, in every direction, until the whole canopy of heaven is overspread, and the gloom at last becomes so intense that, even at mid-day, to speak within bounds, beyond a quarter of a mile no object can be even indistinctly seen. There are however, some degrees of variation in the intensity of the obscurity, but we all know that the measure of distance by the eye upon such an exciting occasion is not likely to be very exact: at one period in a hurricane, just as the ship was dismasted, at the *crisis*, near noon, we could not clearly distinguish the end of the bowsprit from the quarter-deck.

"Every seaman knows the value of the marine barometer; on every occasion we should watch it closely, whether within or without the tropics."

From the description given by the officers of the several ships which have been in hurricanes at different periods, and in different parts of the West-Indies, it appears that they have seldom happened without sufficient warning of their approach having been afforded; such as light variable winds; density of the atmosphere; the clouds low and heavy, rolling over each other with quick motion. It has been observed that, with every appearance of bad weather, if there be much thunder and lightning, a hurricane is not to be expected or apprehended; but they have occurred where lightning *without* thunder has happened. With these prognostics, ships should always be thoroughly prepared to receive a most violent gale; the ships should be made as snug as possible; all the heavy materials carried below, as shot, &c. &c.; the pump-gear examined, and the topmasts got down and secured; for, in every instance of hurricane, the ships have lost their topmasts in half an hour, and the clearing the wreck has interfered with other very essential duties. In H. M. ship *Theseus*, of 74 guns, during a hurricane, the shot-lockers gave way, broke into the well, and carried away the pumps: the ship had then six feet of water in the hold, with the only alternative of baling to save her.

The hurricanes of the West-Indies having been seldom known to extend to the southward of 12° North latitude, the indications above mentioned being given, it may be very desirable, if practicable, to endeavour to reach that degree of latitude, at least, before they

they come on. In every place, where ships may happen to be at anchor, during this season, the pilots will naturally give timely notice, from their own local observations, of the approach of bad weather, but it is generally suspected, by the rising of the water in the harbours, and the heavy hollow surge of the sea, upon the contiguous beaches and kays. The season in which hurricanes are expected, is from August to the full moon of October; and it is said that they most frequently happen three days before, and three days after, the full and change of the moon, during that period.

Trinidad, June, 1831. It will not readily be forgotten that, on the 23rd of June, 1831, Trinidad, in the parallel of $10\frac{1}{2}^{\circ}$ N., experienced one of the most awful storms of wind and rain ever remembered by the oldest inhabitant. The gale commenced at five o'clock on Thursday morning, and continued till eleven; the wind, after shifting from East, North, West, and South, finally settled at S.W., and blew without intermission until three in the afternoon. Eleven or twelve vessels were driven on shore, and several of them severely damaged.

It was subsequently stated that the hurricane was felt at all the southern islands, where the loss it occasioned was very great. Such a storm had not happened at Granada since the year 1780; the devastation was extensive and dreadful; and the loss in that colony was estimated at £80,000. Its course to Yucatan is described hereafter.

Barbadoes, August, 1831. In the night following the 10th of August, one of the most devastating hurricanes that had ever been experienced visited Barbadoes. Not a single house was left uninjured, and the greater part were levelled with the ground. On the 11th it passed over the islands of St. Vincent and St. Lucia, extending a portion of its influence to Martinique and islands to the N.W., and to Granada on the South, but exhibiting its principal violence between $12\frac{1}{2}^{\circ}$ and $14\frac{1}{2}^{\circ}$ N., or the parallels of Barbadoes and Martinique. On the 12th it arrived on the southern coast of Porto-Rico; from the 12th to the 13th it swept over the south side of Hayti, and extended its influence as far southward as Jamaica. On the 13th it raged on the eastern portion of Cuba, sweeping in its course over large districts. The town of Aux Cayes, in Hayti, was almost destroyed by its force, and that of St. Iago de Cuba was very much damaged. On the 14th it was at Havanna, and toward the west end of Cuba. On the 15th it proceeded north-westward, and on the 16th and 17th it arrived on the northern shores of the Mexican Sea, in about the 30th degree of latitude, raging simultaneously at Pensacola, Mobile, and New Orleans, where its effects were continued till the 18th. At New Orleans, on the 17th, it came on in dreadful gales, from N.E. to S.E., accompanied with torrents of rain. Almost all the shipping in the river were driven on shore, and very few of the smaller craft escaped total wreck. The back part of the city was completely inundated. The sugar canes, above and below the city, were laid flat, and the loss was enormous. The gale was felt at Natchez, 300 miles up the river; and hereabout it spent itself in heavy rains, after having occupied a period of six days in its cycloidal course from Barbadoes.

At most of the islands during the hurricane, the winds in the earlier part of the storm were from a northern quarter, and in its later periods, from a southern quarter, of the horizon; from which it results, that the gyratory action was from *right* to *left*, as in the storms which pass to the northward of the great islands, and along the western coast of the Ocean.

The distance passed over by the storm, in its passage from Barbadoes to New Orleans, is equal to 2,100 nautic miles. The average rate, about 14 miles an hour.

It is believed that, of the storms of the last forty years, the route and corresponding character of all those which have been sufficiently violent to receive notice in the marine reports, can be traced in a similar manner, while not an instance of a contrary kind has been known.

The details of the storm in August, 1831, as it affected Barbadoes, St. Vincent, and St. Lucia, were given fully in the *Times* newspaper of the 10th October, in the same year. In the despatch of his Excellency *Sir James Lyon*, governor of Barbadoes, it is noticed that, on the evening of the 10th, the sun set on a landscape of the greatest beauty and fertility, and rose on the following morning over an utter desolation and a waste. The prospect at day-break on the 11th was that of January in Europe,—every tree, if not entirely rooted up, was deprived of its foliage, and of many of its branches; every house within view was levelled with the ground, or materially damaged; and every hour brought intelligence of the most lamentable accidents and of very many shocking deaths.

The evening of the 10th was not remarkable for any peculiarity of appearance; but in the night it began to rain, accompanied with flashes of lightning and high wind, which appeared to come from the north and east; toward midnight the wind increased, and was more to the westward and S.W.; the rain fell in torrents, and the lightning was vivid in the extreme; at one o'clock the hurricane had commenced, and from two o'clock until day-break it is impossible to convey any idea of the violence of the storm; no language can sufficiently express its horrors. The noise of the wind, the peals of thunder, and the rapidly repeated flashes of lightning, (more like sheets of fire,) and the impenetrable darkness which succeeded them, the crash of walls, roofs, and beams, were all mixed in appalling confusion, and every house shook to its foundation.

The tempest did not entirely cease, nor the atmosphere clear up, until about nine o'clock in the morning of the 11th, when many families were found to be buried in the ruins; and the few ships in Carlisle Bay were driven high on the strand.

At an early hour in the morning of the 12th, the storm commenced from the northward on *St. Vincent*, but was not much felt at Kingstown and the shipping on the west until about half-past eight, when its violent effects were excessively destructive. Every vessel at the anchorage, with the exception of one, was cast on shore, and every plantation sustained damage, more or less, by the total destruction of crops and provisions, buildings, works, and negro-houses.

St. Lucia, it appears, did not suffer so much as *St. Vincent*; but even here the destruction was immense. In the night of Wednesday, the 10th, the same night on which the hurricane commenced at Barbadoes, the sky had a very heavy lowering appearance, and early on the next morning, with the wind at north, it began to blow very fresh, which continued increasing, accompanied with rain, until five o'clock, and by seven, or half-past seven, the prognostics of a hurricane appeared; by a little after eight the harbour presented a most awful appearance, the sea ran mountains high, and broke on the south side with the utmost violence, and the vessels in the anchorage became ungovernable. In this condition the town was situated from half-past eight to twelve o'clock, when the wind, which had prevailed in frequent and violent gusts, became more moderate, and before two o'clock it was comparatively calm. During the continuance of the storm it rained unceasingly, but not violently, and the wind seemed to vary very little from its ordinary direction.

The recent discussions on the *progressive* nature of hurricanes appear to have originated in a paper, entitled '*Remarks on the prevailing storms of the Atlantic Coast of the North-American States: by Wm. C. Redfield, of the city of New York*;' which has proved to be a very important and valuable addition to nautical literature. The subject, adopting the '*Redfield Theory*,' has since been amplified and illustrated by Lieut. Colonel Wm. Reid, R.E. and C.B., since governor of the Bermudas, in his beautiful volume, bearing for the title, '*An Attempt to develop the Law of Storms by means of facts, arranged according to place and time, and hence to point out a cause for the variable Winds, with a View to practical use in navigation*;' &c. As connected with this subject, the names of REDFIELD and REID will be imperishable.*

Since 1831, Mr. Redfield has followed up his subject by several additional discussions, especially one entitled, "*On the Gales and Hurricanes of the Western Atlantic*," 1835, and another "*On the courses of Hurricanes, with notices of the Typhoons of the China Sea and other Storms*," *Nautical Magazine*, 1836; the theory has since been further illustrated by Lieut. John Evans (a) of the British navy, as will be shown in the sequel.

In the discussion of this subject Mr. Redfield traces, in some remarkable instances, the progressive nature of the hurricanes, from point to point, and he notices more especially those particularized in the chart prefixed to this work, with others, as follow:

Routes on the Chart.—No. I. Trinidad to Yucatan, over the middle of the Caribbean Sea, June 23 to 28, 1831.

No. II. Barbadoes to the Missisipi, August 10 to 17, 1831.

* "My attention was first directed to the subject from my having been employed at Barbadoes in re-establishing the Government buildings blown down in the hurricane of 1831: when, from the violence of the wind, 1477 persons lost their lives in the short space of seven hours. I was induced to search every where for accounts of previous storms, in the hope of learning something of their causes and mode of action." Reid, "*Law of Storms*," p. 1. This work is illustrated with ten large charts, beside other engravings.

No. III. Guadaloupe to the Bank of Newfoundland, August 17 to 29, 1827.

No. IV. Guadaloupe and Antigua to Charleston, and thence to the Bay of Fundy, September 3 to 10, 1804.

No. V. Antigua, passing over Cuba, to the coast of Texas, August 12 to 18, 1835.

No. VI. Barbuda to Charleston, and thence to the Bank of Newfoundland, August 12 to 19, 1830.

No. VII. From the intersection of 20° N. and 60° W. (N.E. of Barbuda) passing to the West of Bermuda, and thence N.E. to the parallel of $42\frac{1}{2}^{\circ}$, September 29 to October 2, 1830.

No. VIII. From the parallel of 22° (North of Porto-rico) to Cape Hatteras, to the coast of Maine, September 1 to 5, 1821.

No. IX. From near the same spot as No. VIII., on a similar route but more to the eastward, August 22 to 27, 1830.

No. X. From the parallel of 30° N. on the east side of the Florida Stream, to Cape Sable of Nova-Scotia, January 13 to 16, 1831.

No. XI. Inland Storm, over the Lakes, and thence to the Gulf of St. Lawrence, Nov. 10 to 12, 1835.

The route designated as No. I. and described in page 117, is that of the hurricane which visited the islands of Trinidad, Tobago, and Granada, on the 23rd of June, 1831. Pursuing its course through the Caribbean Sea, it was subsequently encountered by H.M. schooner *Minx*, and other vessels, and its swell was thrown with great force upon the south-eastern shores of Jamaica on the 25th, while passing that island, where the wind at this time was light from the northward. After sweeping through the Caribbean Sea the hurricane entered upon the coast of Yucatan, on the night of the 27th, having moved over the entire route from Trinidad to the western shore of the Bay of Honduras, in a little more than 100 hours, a distance of nearly 1700 miles, equal to 17 miles an hour.

Track No. II., is that of the hurricane which desolated Barbadoes in the night of the 10th of August, 1831, as described in pages 117, 118, and which passed Porto-rico on the 12th, Aux-Cayes, in Hayti, and S. Iago de Cuba on the 13th, Matanzas on the 14th, was encountered off the Tortugas on the 15th; in the Mexican Sea on the 16th, and was at Mobile, Pensacola, and New Orleans, on the 17th; a distance of 2000 miles in about 150 hours, exceeding $13\frac{1}{2}$ miles an hour. Its course, until it crossed the tropic of Cancer, was nearly W.N.W. Mr. Redfield adds, "In pursuing its northern course, after leaving the ocean level, it must have encountered the mountain region of the Alleghanies, and was perhaps disorganized by the resistance opposed by these elevations. It appears, however, to have caused heavy rains in a large extent of country north-eastward of the Mexican Sea.

Track No. III. is that of the destructive hurricane which swept over the Windward Islands 17th August, 1827; visited St. Martin and St. Thomas on the 18th; passed the N.E. coast of Hayti on the 19th; Turks Islands on the 20th; the Bahamas on the 21st and 22nd; was encountered on the coast of Florida and South Carolina on the 23rd and 24th; off Cape Hatteras on the 25th; off the Delaware on the 26th; off Nantucket on the 27th; and off Sable Isle and Bank on the 28th. Its ascertained course and progress were nearly 3000 miles in about eleven days; or at the average rate of about 11 miles an hour. The direction of its route before crossing the tropic nearly N. 61° W., and in latitude 40° , while moving eastward, N. 58° E.

Track No. IV. An extensive hurricane of September, 1804, which swept over the Windward Islands on the 3rd of that month; the Virgin Islands and Porto-rico on the 4th; Turks Islands on the 5th, the Bahamas and the Strait of Florida on the 6th; the coast of Georgia and the Carolinas on the 7th; the Chesapeake and Delaware with the continuous portions of Virginia, Maryland, and New Jersey, on the 8th; and the states of Massachusetts, New Hampshire, and Maine, on the 9th; being on the high lands of New Hampshire a violent snow storm. The destructive action of this storm was widely extended on both sides of the track indicated upon the chart, and the same fact pertains in a greater or less degree, to the other storms herein-mentioned. It appears to have passed from Martinique and the other Windward Islands to Boston by the usual curvilinear route in about six days; a distance of more than 2200 miles, at an average progress of about $15\frac{1}{2}$ miles an hour.

Track No. V. The route of the hurricane which ravaged Antigua, Nevis, and St. Kitts, in

in the afternoon and night of August 12, 1835; St. Thomas, St. Croix, and Porto-rico, on the 13th; Hayti and Turks Islands on the 14th; the vicinity of Matanzas and Havana on the 15th; was encountered off the Tortugas, on the Bank of Florida, on the 16th; in lat. $27^{\circ} 21'$, long. 94° , and other points on the 17th and 18th, and at Matamoras, near the Mexican shore, lat. $26^{\circ} 4'$, on the 18th, where it was most violent during the succeeding night. It also passed over Galveston Bay, in Texas, and there blew with violence from the S.E., while at the mouths of the Mississippi and along the northern shores of the Gulf the gale was not felt. This storm is remarkable, as moving more directly and farther to the west than is usual for storms which pass near the West-India Islands, it having reached the Mexican shores before commencing its sweep to the northward. Course about N. 73° W.; progress more than 2200 miles in six days: nearly equal to $15\frac{1}{2}$ miles an hour.

Track No. VI.—The memorable gale of August, 1830, described hereafter, which, passing close by the Windward Islands, visited St. Thomas on the 12th; was near Turks Islands on the 13th; at the Bahamas on the 14th; eastern coast of Florida on the 15th; coasts of Georgia and the Carolinas on the 16th; off Virginia, Maryland, New Jersey, and New York on the 17th; off George's Bank and Cape Sable on the 18th; and over the Newfoundland Bank on the 19th; having occupied about seven days in its ascertained course from near the Windward Islands, a distance of more than 3000 miles; the rate of its progress being equal to 18 miles an hour. If, adds Mr. Redfield, we suppose the actual velocity of the wind, in its rotary movement, to be five times greater than this rate of progress, which is not beyond the known velocity of such winds, it will be found equal, in this period, to a rectilinear course of 15,000 miles. The same remark applies, in substance, to all the storms which are now passing under review.

Track No. VII., was encountered to the northward of the Caribbee Islands on the 29th of September, 1830; its route was to the eastward of all those previously described, and was found on the Grand Bank of Newfoundland October 2, having caused great damage and destruction on its widely extended track, to the many vessels which fell in its way. The ascertained route may be estimated at 1800 miles, and the average progress 25 miles an hour.

Track No. VIII. experienced in September, 1821, as more fully shown hereafter. This hurricane was extremely violent; it was encountered to the north-eastward of Turks Islands on the first of the month; to the northward of the Bahamas, and near the latitude of 30° on the 2nd; on the coast of the Carolinas early in the morning of the 3rd; and from thence, in the course of that day, along the coast of New York and Long Island; and it is represented to have continued its course across the states of Connecticut, Massachusetts, New Hampshire, and Maine. The diameter of the storm appears to have exceeded 100 miles; its ascertained route and progress about 1800 miles in 60 hours, equal to 30 miles an hour.

A similar but less violent storm swept along the same portion of the coast of the United States on the 28th of April, 1835.

Track No. IX. The route of a violent and extensive hurricane which was encountered to the northward of Turks Islands August the 22nd, 1830; northward of the Bahamas on the 23rd; and off the coast of the United States on the 24th, 25th, and 26th, of the same month. It produced much damage, but scarcely reached the American shores. Its duration was about 40 hours, and progress more tardy than some others.

Track No. X. A violent hurricane and snow-storm, which swept along the American coast from the parallel of 30° N. on the 5th and 6th of December, 1830. This track corresponds to another storm, of similar character, which swept along the coast on the 13th, 14th, and 15th, of January, 1831. These violent winter storms exhibited nearly the same phases of wind and general characteristics as those which appear in the summer and autumn.

Track No. XI. The violent inland storm which passed over the Lakes Erie and Ontario on the 11th of November, 1835. This storm was very extensive, spreading from the sea-coast of Virginia into the Canadas, to a limit unknown. The anterior portion of this gale was but moderately felt, and its access was noted chiefly by the direction of the wind and the great fall of the barometer; the violence of the storm being exhibited chiefly by the posterior and colder portion of the gale, as is common with extensive overland storms. The regular progression of the storm, in an easterly direction, was established by facts, collected by Mr. Redfield, from the borders of Lake Michigan to the Gulf of St. Lawrence and the coasts of New England and Nova Scotia.

In perusing the descriptions above, it is to be noted that the lines on the chart representing the routes are given by Mr. Redfield as but approximations to the centre of the track, or course of the several storms; and the gales are to be considered as extending their rotative circuit from 50 to 300 miles, or more, on each side of the delineations; the superficial extent of the storm being estimated both by actual information and by its duration at any point near the central portion of its route, as compared with its average rate of progress.

The circular figure which appears upon the chart, on tracks No. I., V., and VII., will serve, in some degree, to illustrate the course of the wind in the various portions of the superficies covered by the storm, and also to explain the changes in the direction of the wind which occur successively at various points during the regular progress of the gale.

HURRICANES of 1780.—From want of adequate information on the subject, it was formerly assumed that the memorable hurricane of the year 1780, which dispersed and destroyed nearly all the British fleet in the West-Indies, took its course from W.N.W. to E.S.E.; but, from authentic documents, acquired by Colonel Reid, it has been shown that two great storms occurred nearly at the same time, and these have been frequently confounded together, and considered but as one. The first destroyed the town of Savanna-la-Mar, on the 3rd of October, 1780. The second, and by far the greater one, passed over Barbadoes on the 10th and 11th of the same month, as will be shown hereafter.

The first or *Savanna Hurricane* appears to have progressed from the S.E. to the western part of Jamaica, and thence passed in a N.N.E. direction over Cuba, the Great Bahama Bank, and Island of St. Salvador, continuing nearly in the same direction to the parallel of 35° N., in longitude 69° W., whereabout its ravages probably ceased. Between the 5th and 7th of October it annoyed the squadron under Rear-Admiral Rowley, between the parallels of 28° and $29\frac{1}{2}^{\circ}$, longitude $72\frac{1}{2}^{\circ}$ to 75° ,* previous to which, at half-past 5 in the morning of the 4th, the *Phoenix* frigate, under Sir Hyde Parker, was driven on shore and wrecked at about three leagues to the eastward of Cape Cruz, Cuba. At 11 p.m. of the 2nd this ship was off Port Antonio, Jamaica, when the wind began to blow, with a stormy appearance to the eastward, and she then close-reefed her topsails. At 8 a.m. of the 3rd, the wind was E.N.E., with occasional heavy squalls; and Sir Hyde remarked that the weather had the same appearance as he had observed in the commencement of a hurricane in the East-Indies. He then ordered the topsails to be taken in, and wore the ship, in order to keep mid-channel between Jamaica and Cuba.

At 2 p.m. the *Phoenix* lay-to, with a storm mizen staysail, and her head to the northward. When night set in the storm increased with great violence. At midnight the wind was S.E., and the ship drawing upon Cuba, the captain proposed to wear her, but no canvas could withstand the wind at this time, and under the direction of the first-lieutenant, Archer, she was wore by sending 200 of the crew into the fore-rigging. When about to cut away the masts the ships took the ground, and if she had not been driven on shore she must have foundered. All the ship's company were saved, excepting 20, most of whom were lost with the main-mast, and washed overboard.

Of the ships in Rear-Admiral Rowley's squadron, abovementioned, on the 6th and 7th of October, the *Hector*, *Berwick*, *Bristol*, *Trident*, and *Ruby*, were disabled, and mostly dismantled. They had been sent by the Admiral, Sir Peter Parker, to convoy a fleet part of the way to Europe, and had subsequently the misfortune, in the same month, to meet the great hurricane, next described.

The Savanna hurricane seems to have originated within the Caribbean Sea, and not to have passed over the Eastern Antillas nor touched on the continental coast to the southward. The Scarborough frigate, which was lying a few days before in Montego Bay, was lost, and it is supposed that she foundered near the western end of Jamaica.†

The GREAT HURRICANE, which commenced at Barbadoes on the 10th of October, 1780, was preceded in the evening of the 9th by weather remarkably calm, but the sky surprisingly red and fiery, and during the night much rain fell. The storm approached from

* Marked * in the Chart.

† Col. Reid, 'Law of Storms,' pages 276—283, and chart IX. The colonel, as in other cases, adds copious details, which plainly show where the hurricane did not operate, either to the east or to the west.

the S.E., and the ships of the squadron stationed here experienced the hurricane each in turn according to the place she was in. A letter from Dr. Blanc, dated from the *Sandwich*, Sir Geo. Rodney's flag-ship, stated that it was not previously apprehended that there would be anything more than such a gale as they experience, from time to time, at that season; but, on the evening of the 10th the wind rose to such a degree of violence as clearly to amount to what is called a *hurricane*. At 8 p.m. it began to make impression on all the houses, by tearing off the roofs, and overthrowing some of the walls. As the inhabitants had never been accustomed to such a convulsion of nature, they remained for some time in security, but they now began to be in the utmost consternation. * * * * It was thought to be at its greatest height at midnight, and did not abate considerably until 8 next morning. During all this time most of the inhabitants had deserted their houses, to avoid being buried in the ruins; and every age, sex, and condition, were exposed in the fields to the impetuous wind, incessant torrents of rain, and the terrors of thunder and lightning. Many were overwhelmed in the ruins, either by clinging for shelter too long in the buildings, or attempting to save what was valuable, or by unavoidable accidents in the fall of walls, roofs, and furniture, the materials of which were projected to great distances. Even the bodies of men and cattle were lifted off and carried above the ground. From an estimate of the number of deaths reported to the governor they amounted to more than 3000. All the fruits of the earth were destroyed; most of the trees torn up by the roots, and many of them stripped of their bark. The sea rose so high as to destroy the fort, carrying the great guns many yards from the platform, and demolishing the houses near the beach. A ship was driven on shore against one of the buildings of the naval hospital, which, by this shock, and by the impetuosity of the wind and sea, was entirely destroyed and swept away. * * * * The mole-head was swept away; and ridges of coral rock were thrown up to above the surface of the water: but the harbour and roadstead were, upon the whole, improved, having deepened in some places six feet, in others many fathoms. The crust of coral, which had been the work of ages, leaving a soft oazy bottom, and many shells and fish were found ashore which had previously been unknown.

The hurricane passed, in succession, over the islands of St. Vincent, St. Lucia, Martinique, and Dominica, and included within its area those of Guadaloupe, St. Christopher, St. Eustatius, &c. At St. Vincent every building was blown down, and the town destroyed. At St. Lucia, which was near the centre of the hurricane, all the barracks and other buildings were blown down, and the ships driven to sea. At Martinique, likewise, all the ships that had brought troops and provisions were blown off the island. On the 12th, four ships with their crews, foundered in Fort Royal Bay. The other ships were blown out of the Roads. In the town of St. Pierre, on the N.W. coast, every house was blown down, and more than 1000 people perished. At Fort Royal the cathedral, seven churches, other religious edifices, many public buildings, and 1400 houses, were blown down, as was the hospital of Nôtre Dame, in which were 1600 sick and wounded, the greatest part of whom were buried in the ruins. The number of persons who perished in Martinique is said to have been 9000. Dominica likewise suffered greatly, and Guadaloupe was within the northern verge of the hurricane.

At *St. Eustatius*, although not far within the N.E. verge, the loss was very great. On the 10th of October, at 11 a.m. the sky on a sudden blackened all round; it looked as dismal as night, attended with the most violent rains, thunder, lightning, and wind. In the afternoon the gale increased; seven ships were driven on shore near the north point, dashed to pieces on the rocks, and their crews perished. Nineteen vessels cut their cables and went to sea. In the night every house to the northward and southward was blown down, or washed away with the inhabitants into the sea, a few only escaping. The houses to the east and west were not so much hurt till the afternoon of the 11th, when the wind on a sudden shifted to the eastward; and at night it blew with redoubled fury, and swept away every house, but the forts, barracks, hospital, cathedral, and four churches, remained. Here between 4000 and 5000 persons are supposed to have lost their lives.

Advancing northwestward, the centre of the hurricane on the 14th had reached to the Mona Passage, on the West of Porto-Rico. Here the *Ulysses* and *Pomona*, with a fleet under their convoy, suffered greatly, and here the *Deal Castle* frigate was wrecked. Another frigate, the *Diamond*, fell within the western verge of the storm on the 15th, but happily escaped by passing Alto-vela, on the south side of Hayti. Above the parallel of 20° the *Stirling Castle*, 64, was lost on the Silver Key Bank, and most of her crew perished. On the 18th we find, in about 22½° N., and 69° W., the *Trident*, *Ruby*, *Bristol*, *Hector*, and *Grafton*

Grafton, men-of-war, on the S.W. verge of the storm. The ship last mentioned, on the 16th, at noon, was in latitude $26\frac{1}{2}^{\circ}$, longitude (by estimation) $71^{\circ} 30'$; heavy gales and cloudy weather; lying-to under trysails; the gales split the sails to ribands. On the 18th, lying-to; strong gales and heavy squalls. 17th to 18th, carried rapidly to the S.E. ward, when the *Trident*, *Ruby*, and *Hector*, came in sight, as above. At 11 a.m. spoke the latter, in great distress.

The *Ruby*, *Trident*, and *Bristol*, on the 15th were as high as $27\frac{1}{2}^{\circ}$ N., and they, too, from the western border of the hurricane, were driven to the southward, until they joined company.

Here the detail becomes imperfect, until we reach the Bermudas; but to the N.E. of these isles we find the *Berwick*, 74, on the 19th, which had fallen, on the 17th, within the border of the hurricane from a position to the W.N.W., near the latitude of 35° . This ship had previously been one of Rear-Admiral Rowley's squadron; she was proceeding to England under jury-masts, and had reached to the north of the latitude of the Bermudas when the hurricane overtook her. On the 16th, at 11 a.m., during calm, there was a great swell from the eastward. On the 17th, at one p.m., she was taken aback; wore ship and handed topsails: at 3 squally, with rain, loosed the topsails: 6 to 8, wind E. by N., fresh gales. On the 18th, winds variable from the eastward, E. by N. to E.S.E.; after midnight strong gales and heavy squalls. At noon, by estimation, Bermudas S. 53° E. 31 leagues. 19th, at one a.m., weather moderate, and the ship proceeded on her course.

On the 18th, about fifty vessels were driven on shore at Bermuda.

We have been the more particular in giving these details, from having formerly been misled by imperfect data. In the delineation of the 'Great Hurricane,' given by Col. Reid, he first assumes a circle having a radius of about 170 miles, which gradually expands, on its N.W., North, and N.E., course to 270° , with, we may presume, a diminished and proportionate momentum, on the parallel of Bermuda. The colonel observes that, on reading the logs and the various accounts of this hurricane, and comparing the different reports of the wind, it will be found that no storm yet described more strongly than this proves the rotatory nature of hurricanes; and, after attentive consideration of this tempest, in addition to the details of many others, it seems difficult to refuse belief to this being their mode of action.

HURRICANE OF 1830.—The storm which passed the city of New York, on the 17th of August, 1830, was there, and along all the coast northward of Cape Hatteras, considered as a north-east storm. (See chart.—Route VI.)

It appears that this commenced at the island of St. Thomas, in the West Indies, on the night between the 12th and 13th of August. On its progress, in the afternoon of the 14th, it commenced at the Bahama Islands, and continued during the succeeding night, the wind almost round the compass during the existence of the storm. On the 15th, in the Florida Channel, its effects were very disastrous. Without the Strait, in lat. $26^{\circ} 51'$, long. $79^{\circ} 40'$, the gale was severe from N.N.E. to S.W. Late on the same day, off St. Augustine, it was equally so. At 20 miles north of St. Mary's, from 8 p.m. on the 15th, to 2 a.m. on the 16th, it was from an eastern quarter, then changed to S.W., and blew till 8 a.m.

Off Tybee and at Savanna, in the night of the 15th, it changed to N.W. at 9 a.m. on the 16th, and blew till 12 h. On the 16th, at Charleston, the gale was from S.E. and east, till 4 p.m.; then N.E. and round to N.W. At Wilmington (N. Carol.) the storm was from the east, and veered subsequently to the west. In the vicinity of Cape Hatteras, at sea, the storm was very heavy from S.E., and shifted to N.W.

Early in the morning of the 17th, the gale was felt severely in the Chesapeake, from the N.E. Off the Capes of Virginia, on the 17th, lat. $36^{\circ} 20'$, long. $74^{\circ} 2'$, 'a perfect hurricane' from south to S.S.E., from 5 a.m. to 2 p.m., then shifted to N.W.

Off Cape May, lat. 39° , long. $74^{\circ} 15'$, in the afternoon of the 17th, a heavy gale from E.N.E. Coast of New Jersey, same afternoon, heavy at N.E. Again, in lat. 39° , long. 73° , at E.N.E. In the same latitude, long. $70^{\circ} 30'$, a 'tremendous gale,' commencing at S.S.E., and veering to north.

Afternoon and evening of the 17th, at New York and in Long Island Sound, gale at N.N.E. and N.E. Off Nantucket Shoals, at 8 p.m. severe at N.E. by E. In the night of the 17th, off Nantucket, and in the Gulf Stream, lat. $38^{\circ} 15'$, long. $67^{\circ} 30'$, 'tremendous,' commencing at South, and veering, with increasing severity, to S.W., west, and N.W. Peninsula of Cape Cod, in the night between the 17th and 18th, severe at N.E.—18th, at Salem and Newbury, heavy gale from N.E. In lat. $39^{\circ} 51'$, long. 69° , severe from S.E., suddenly

suddenly shifting to north. In lat. $41^{\circ} 20'$, long. $66^{\circ} 25'$, 'tremendous hurricane,' from N.N.E.

Off Sable Island, in the night of the 18th, lat. 43° , long. $59\frac{1}{2}^{\circ}$, 'tremendous heavy gale' from south and S.W. to west and N.W. In lat. 43° , long. 58° , a severe gale from the south; the manner of change not reported.

This remarkable storm appears to have passed over the whole route above described in about six days, at an average of about 16 miles an hour; the duration of its most violent portion, at the several points over which it passed, may be stated at from seven to twelve hours; and the width of its track is supposed to have been from 150 to 200 miles.

"On the western part of the Atlantic Ocean, between the parallel of New York and the northern limit of the trade-wind, the prevailing winds, for a considerable period, both previously and subsequently to the occurrence of this storm, were south-westerly, or from the southern quarter; and over the whole breadth of the Atlantic, on the route frequented by ships in the European trade, fresh south-western or westerly winds also prevailed at the same period, for many weeks. These facts are well established by numerous marine journals, which have been consulted in relation to this subject."

Of the vorticular or rotative character of the storm, striking evidence has been afforded by the journals of two ships, the *Britannia* and the *Illinois*, both bound from America to Europe; the particulars of which are fully given in the Exposition by Mr. Redfield.

In about a week after the storm last described, another occurred, which passed New York on the 26th and 27th of August, and which was, also, on this coast, a N.E. storm, of about three days' duration. From the eastward of the Bahamas it appears to have passed northwardly between the Florida Stream and the Bermudas; and touching the American shore near Cape Hatteras, raged with great fury for about forty hours at each locality, as it swept the great central curve of the coast; and, passing from thence, continued its course over George's Bank, in a north-easterly direction. It was evidently of greater compass, and slower progress, than the preceding storm, as is proved by a collation of the various reports of mariners and its long duration, and its effects were almost equally violent.

The next remarkable series of hurricanes appear to have originated in the vicinity of the Windward Islands, near the close of September, 1830, and which, passing westward of the Bermudas, on a course nearly north, assumed thence a more easterly course, toward the southern edge of the Grand Bank of Newfoundland. (*See the chart, Route VII.*)

This storm was very disastrous. In lat. $20\frac{1}{2}^{\circ}$, long. 63° , it commenced, on September 29, at one *p.m.* and continued till half-past six *p.m.* from N.E. and S.W. alternately. On the same day it passed through lat. $22^{\circ} 46'$, long. 65° . At night, on the 30th, in lat. $26^{\circ} 7'$, long. $66\frac{1}{2}^{\circ}$, 'very heavy,' for $5\frac{1}{2}$ hours. On the 1st of October it arrived at lat. $30^{\circ} 38'$, long. 63° ; severe at S.E., shifted to N.W.: thence it was found in lat. 33° , long. $66\frac{1}{2}^{\circ}$; lat. $34^{\circ} 9'$, long. $66^{\circ} 12'$; lat. 35° , long. 68° ; lat. 38° , long. 63° ; lat. $38\frac{1}{2}^{\circ}$, long. 57° ; lat. 40° , long. 61° ; lat. $40^{\circ} 25'$, long. $58^{\circ} 24'$; lat. 41° , long. 55° , and very severe. By an average estimate of rates and distances, it appears to have proceeded at the rate of about 27 miles an hour.

The extensive hurricane of 1804, which swept over most of the Windward Islands in the West Indies, commenced at Martinique on the 3rd of September, reached Savanna on the 7th, Boston on the 9th, and became a *snow storm* on its arrival in the interior of New Hampshire.

The great gale of 1815 commenced at St. Bartholomew's, on the 18th of September, and reached Rhode Island on the morning of the 23d, where it was awfully destructive from the S.E., while in the south-eastern parts of Massachusetts it was then blowing at south; at New London from east to S.E.; and at New York from north to N.N.W.*

A violent N.E. snow-storm, Dec. 6, 1830, swept along the whole of the Fredish coast in the same manner, it being experienced from the southward and westward by vessels which were at a certain distance from the coast.

A S.E. storm, in September, 1821 (*see Chart, Track VIII.*), was experienced in the central parts of Connecticut, commenced blowing violently from E.S.E. and S.E., at about

* It appears that, previous to this, on the 9th of August, 1815, a furious hurricane occurred on the Gulf Stream, by which H.M.S. *Warrior*, Capt. J. T. Rodd, in latitude $40^{\circ} 29'$, longitude $59^{\circ} 58'$, was driven out of the stream, and to the northward of it, as shown by Major Rennell in his 'Investigation,' pp. 169, 202, 238.—ED.

6 p.m. on the 3rd of September, having been preceded by a fresh wind from the southern quarter and flying clouds. It continued blowing in heavy gusts, and with increasing fury, till about 10 p.m., when the wind suddenly subsided. A calm or *hull*, of perhaps 15 minutes' duration, ensued, but was terminated by a violent gust from the N.W., which continued till about 11 p.m., and then gradually abated. Much damage was sustained, and fruit-trees, corn, &c. were uniformly prostrated toward the N.W.

At New York the same storm was experienced, with at least equal violence, about three hours earlier than in Connecticut, but blowing from a more eastern quarter. In the north-eastern parts of Massachusetts it was experienced some hours later; and, at Providence, in Rhode Island, the storm was felt in the south-eastern quarter, but not severely; as was, also, the case in the south-eastern parts of Connecticut. In the N.W. portions of the latter state, and the adjacent towns of Massachusetts, the gale blew with its chief violence from the N.W. quarter, and the trees and corn were uniformly prostrated toward the S.E.

At New York the gale was from N.E. to east, and commenced blowing with violence at 5 p.m., continued with great fury for three hours, and then changed to west. More damage was sustained in two hours than was ever before witnessed in the city, the wind increasing during the afternoon, and at *sun-set* was a hurricane. At the time of *low-water* the wharfs were overflowed, the water having risen 13 feet in one hour. Previous to the setting in of the gale the wind was from south to S.E., but changed to the N.E. at the commencement of the storm, and blew with great fury till evening, and then shifted to the westward.

The following HURRICANES, in addition to those already noticed, have been described by Colonel Reid, in his "Law of Storms."

1. *Barbadoes Hurricane*, over the N.E. part of Hayti, and thence over the Great Bahama Bank to the coast of Florida, 26th July to August 1st, 1837.

2. *Antigua Hurricane*, over Porto-Rico, Turk's Islands, St. Salvador, Abaco, and Darien, including St. Augustine and Charleston, August 4th, 5th, and 6th, 1837.

3. *Hurricane to the N.E. of the Caribbee Islands*, thence to the N.W. to the parallel of 30° N., and thence N.E. to latitude 40° in longitude about 60° W. 12th to 22nd of August, 1837.

The hurricane of the 26th of July (No. 1, above) passed over Barbadoes in the morning of that day: at 10 in the night following it was at Martinique, and at this time it had ceased at Barbadoes. At midnight of the 26th it reached St. Croix, and by the 30th the Strait of Florida, where some vessels were wrecked by it and many damaged. It then took a more northerly direction, and was, on the 1st of August, at Jacksonville, in Florida. From Jacksonville it passed over Savanna and Charleston, and thence in a direction eastward of north.

The Hurricane, No. 2, above, was at Antigua, on the 2nd of August; by the 5th and 6th on the coasts of Florida and Georgia, where it crossed the line of the Barbadoes hurricane (No. 1), and it seems to have extended, on the 8th, to Pensacola. The American Journals of 1837 stated that it had been experienced at Savanna and other towns in the vicinity. It appears that it commenced there at noon, and continued for a whole day with unabated fury. The destruction to the shipping was very great, and numerous buildings were blown down. At St. Mary's the effects were also felt severely. The devastation extended to the River St. Juan, where the crops were entirely destroyed.

A letter from *Darien*, dated August 10, stated that, during the past week they had there been visited by a storm which had not been equalled since one of the year 1824. The wind on Sunday, Aug. 6th, in the morning, blew fresh from the N.E.; in the after part of the day it had shifted round to S.E. when rain began to fall in heavy torrents. The wind then rose very high, and began to blow with fearful violence, tearing up the oldest oaks and mulberry trees by the roots, while limbs and branches of the different trees were flying in all directions. The water of the river then rose and covered the rice plantations so completely, that they appeared to the eye to form part of the river. Accounts from the country represented the cotton crops to be all but destroyed, the corn broken down, and many houses unroofed.

At Jacksonville, on the river St. Juan, to the southward, it was stated that they had the hurricane for two days. Houses innumerable destroyed, two great stores demolished, and crops completely laid waste in the fields. Of vessels which materially suffered hereabout, the *Bolivar* drifted nine miles over the marsh, and was left about 600 yards from the bed

In order to simplify this subject, and render it perfectly clear, a copy of the figure annexed (obligingly communicated to the Editor by Lieut. Evans, in March, 1837), may be drawn on thick paper or card-board, upon an *enlarged scale*. The outer circle to be *fixed*, representing the points of the horizon; the inner circle, with index, to be moveable, and attached, with a button in the centre, so as to revolve on the outer or under circle; thus the inner circle may represent the *phases of the wind*, as it gyrates round a centre; the arrows showing the revolution of the aerial current from right to left. The moveable circle is subdivided into four quadrants, for the purpose of facilitating the mode of operation.

Here, says Lieut. Evans, it will be obvious that, if a vessel be caught under the N.N.W. verge of the hurricane, the wind, as shown by the arrow annexed to that point, will be, apparently, from E.N.E., and the changes will be seen as they occur progressively. On the N.E. verge of the hurricane the wind will appear to come from the S.E. If on the north verge the wind will be east, and if on the west, it will be northerly, as shown in the figure.

The subject, when considered, will be readily understood; only bearing in mind that the shifts of wind will appear, *in most cases*, to be from left to right, while the general wind is actually pursuing quite a contrary direction.

To use the instrument, formed as above, place the moveable circle upon the under one, east, in juxta-position with the north point of the horizon. The vessel's position may be marked as a stationary spot on the outer or under circle—say under the N.N.W. verge, where the wind is at E.N.E.: then move the upper circle in the line of progression to the N.W., which is the general line pursued, and the changes of the wind will be seen as they occur on the object marked.

The direction of the wind is independent of the progression of the storm, and as the current of air, whilst sweeping round the *gyrus* or centre pursues one unvaried path, it follows that, under every point of the horizon, there will be experienced a wind blowing at right angles to it, unchangeable in its direction; thus, under the *north* point of the horizon there will be an east wind; under the *south* point a west wind; and under the *east* point a south wind. So that, were the storm stationary, a ship scudding round the entire circle, from any given position, would experience the wind from every point of the compass, in regular succession; but this, as the fact is, can very rarely, if ever, happen, on account of the progressive movement of the entire meteor.

As these storms do not pursue a uniform velocity, the rate of their actual progression can be arrived at only after they have ceased to act on any two or more stationary spots; or upon two ships, by noting the exact time each experienced the first shock of the hurricane, and also the time of its departure, respectively. Some cause or causes operate to accelerate the rate at one time, and to retard it at another.

On reference to the preceding diagram it will be seen, that if a ship first encounters a hurricane with the wind at E.N.E. she will be under the N.N.W. verge, and as the progression is (generally) to the N.W. the changes of wind will be to the eastward, going round to the S.E. and south, and ending with it at about S.W. by S. *Apparently* these changes will be from right to left.

It becomes necessary here to observe that, although the general medium course of the hurricane in the West Indies has been found to be N.W., yet in two or three instances we have reason for believing that either a deviation in particular parts of its course, or otherwise a vibration or oscillation of the entire meteor, has taken place. Any deviation, however, from the general course pursued by the storm to the N.W. can easily be detected, from the veering of the wind; as that ought to be regular, when the progressive path of the storm is regular, except at or near to the vortex. For instance, if the hurricane commences at E.N.E., and the wind does not follow the regular successive changes, as noted above, we may be assured that the storm is not pursuing a course to the N.W.; and the true line of progression may be ascertained by the circle, so as to gain the corresponding points of change to those which occur.

Again, if the storm commences at north, the wind ought to veer (under the same progressive direction of N.W.) to the N.W., west, and end with it about W. by S. or W.S.W.

But

But if, after the wind has got to west, the storm should end with it at south (as it did at Antigua in 1804), we shall be assured that a deviation had taken place to the westward in the progression, or otherwise a vibration or oscillation to the southward.

The uncertainty of these aberrations should not deter the navigator from placing confidence in the general remarks here given, as these (based on Mr. Redfield's theory) have been arrived at from experience, from facts which are incontrovertible, and from a careful study of the subject; and besides, should these variations not happen, and to a certainty they do not always occur, (at least on the ocean,) he may benefit by them; whilst, under a case of their occurrence, no rules can possibly be given for his guidance; he must place his vessel in the best position his judgement points out, and passively await the result.

We shall now endeavour to explain, in the plainest manner we can, the operation of the wind, and its effects on a vessel in each of the quadrants, when the progression is to the N.W.

First or N.E. quadrant.—Wind from south to east. The changes of wind, if a vessel be lying-to, will appear to take place from *left* to *right* throughout; as the wind will *seem* to draw round from the eastward toward the south, although it is in fact proceeding the contrary way, or from right to left.

The navigator's attention is particularly directed to this apparent paradox; for, whilst he notes the wind down in his journal as veering with the sun, it is all the time, as remarked before, going the contrary way! The delusion is occasioned by the progression of the hurricane to the N.W., which by receding from the vessel's position, has the effect of bringing up the more southerly *phases* of the wind in succession; and, consequently, imparting to these, an *apparent* contrary direction to that which the whole current of air is actually pursuing. This deceptory process is somewhat similar to the well-known astronomical illusion every day before our eyes: we allude to the apparent course of the great luminary. Not only can we imagine from the evidence of our sense of seeing (not at all times to be depended upon) that the sun is moving from east to west, but in common parlance such idea is invariably expressed; yet every body knows that this is only apparent, and that the delusion is occasioned by the diurnal rotation of the earth round its axis from west to east.

This point, however, once clearly understood, will no longer perplex us; and the best mode to adopt, in order to avoid being puzzled is, to use the moveable circle with the *phases* of the wind marked on the rim, placing it over the fixed circle with the points of the horizon marked to represent the ocean.

We now proceed with the first quadrant. If a ship scuds to the northward, the direction of the alterations of the wind will in a great measure depend upon her velocity, as she is crossing obliquely the course of the progression: if she keeps pace with the *northerly* advance of the storm, the wind will remain the same; if she exceeds it, the wind will draw round to the eastward; and if the progression outstrips her, the changes will be to the southward. In either of the latter cases, the variations will be few, in all probability; and the westerly progression may be expected to cause the ship to be speedily thrown out of the circle of operations.

A ship is likely to enter this quadrant only under the northern verge from the north to the N.E. point: if she happens to be standing to the southward, within the limits of the trade wind, she will be liable to be taken aback; but, if standing to the northward, of course she will not.

Second or S.E. quadrant. Wind from west to south. A ship lying-to, with the wind from any point between south and S.W., the shifts will be from the southward toward the west, *apparently* from left to right. If the wind be between the S.W. and west, there will be few if any changes, as the ship will be near the posterior line of the progression; what changes may happen will probably be from west toward the south. The vessel will soon be clear of the commotion. It seems pretty evident that a vessel will not, in the first instance, be liable to fall under the S.E. verge in this quadrant, for this reason,—that she cannot overtake the hurricane, as its velocity, in all probability, at any time would exceed her rate of sailing. She may, however, just touch laterally about the southern verge, where she would get the wind from the west. To enter this quadrant, therefore, a ship must pass through some other.

Third or S.W. quadrant. Wind from north to west. A ship lying-to, the wind from the northward

northward (as the storm progresses) will draw round to the westward from right to left truly as apparently so.

As a ship scuds to the southward and eastward, the wind will draw round in the same manner as mentioned above. It appears obvious that, a vessel falling into the storm, under any point in this quadrant, would merely feel the "*brush*," but she will be liable to be taken aback if standing to the northward or north-eastward, on first entering the scene of operation, supposing her to be within the limits of the trade wind.

Fourth or N.W. quadrant. Wind from east to north. If a ship lies to with the wind at any point between East and N.E., it will *appear* to draw round from left to right, or from N.E. by E. to East. If she lies to with the wind between N.E. and North, the shifts will be from right to left, or from N.E. by N. to North. Under the N.W. verge (where the wind is at N.E.) a ship being there in the line of the anterior progression, will drift, probably, into, or very near to the centre of the circle, which, on account of the sudden shifting of the wind there, should, if possible, be avoided, as there the greatest danger may correctly be considered as existing.

If a ship scuds, under the same circumstances of winds, the changes will appear the same as above given; but slower in the first instance, and quicker in the second, for these reasons: that in the one case the points of change are receding from her as she advances; and in the other, they draw toward her approach, her velocity through the water accelerating the alterations; and this difference is occasioned by the progression to the N.W.

Within the limits of the trade wind, if a ship be standing to the southward, she will not be liable to be taken aback on striking the storm in this quadrant, but she would be so if steering to the northward.

It should be constantly held in remembrance that, under all circumstances the wind remains the same; or, in other words, that, under any given point of the horizon, the wind will be found to blow from a particular direction unchangeable, so that there is actually no shifting; the changes observable being occasioned by the progression of the storm to the N.W., and the movements of a vessel.

From this peculiar character of the tempest, the course which a ship will pursue through the circle of operations, as also the successive changes of the wind, as these appear to take place, become an easy problem to solve after having noted the point from which the first wind, or the first shift, is felt; *provided* no divergency in the course, or vibratory motion of the meteor, take place.

Although a ship in most cases, we imagine, may be more likely to fall into the circle of operations under the north-western verge of the storm, than in any other part, as that is the anterior advancing section, no general rules can be laid down for the guidance of the mariner for placing his ship in such a position so as to insure her not to be taken aback when the storm shall be first felt, because until that moment arrives, when the direction of the first blast is to become his "*polar star*," he cannot with unerring certainty anticipate his position with respect to the particular verge of the hurricane that is approaching toward him.

Under such unavoidable circumstances, he must use his best judgment in preparations for meeting the worst, and be ready to lay his vessel to, or to scud, according to the direction of the wind first experienced. To be quite sure of what he is about to do, perhaps, the safest plan would be to wait until the first *shift* takes place after the commencement of the storm, by which measure, his position would be confirmed, a point of material consequence to arrive at.

Every experienced seaman, after having given the theory his best attention, and made himself familiar with the whole working of the wonderful meteor, will of course follow the dictates of his own mature judgement upon an occasion that will assuredly call forth the full exercise of it. Without, therefore, presuming, or desiring to obtrude upon him, the manner we ourselves should act under a case of such uncertainty, which would demand all the resources of mind of the individual commander, for the first time placed in such a dilemma, we shall nevertheless offer it here as a mere illustration.

Let us then suppose that we are steering to the northward in our ship, within the limits of the trade-wind (call it E.N.E.) and that certain prognostics appear, which our judgment informs us forebode a storm. If it happens to be the hurricane season, we are bound by prudence to prepare the ship for encountering a tempest of that nature, even though

appearances may induce us to think that such would not eventually happen; for, whether a mere common gale or a hurricane should follow, every sensible person will admit that during that season it is the wisest as it is the safest plan, to be prepared to meet the worst that may happen under such appearances. It must be recollected that nature herself proclaims the warning, and her admonitions are not to be disregarded with impunity.

Without loss of time we make the ship snug, hatches battened down, &c. This done, we should bring her to the wind on the starboard tack, with her head to the northward, with a fore and a mizen storm stay-sail. We cannot, as was said before, anticipate under what verge of the storm we shall enter, but we shall have done all that prudence can dictate, by lying-to *without square sails*, and of course making our minds up to have the fore-and-afters blown to shreds by the new wind, come from whatsoever quarter it may. In this position we must wait patiently until the first shift of wind takes place. If this should be from E.N.E. to E. by N. and East, we should make ourselves easy in the position obtained, with reference to the particular verge of the storm, as well as in that we had placed the ship; having the assurance (from the shift of wind) that the anterior verge which had struck us, would be now running away at the rate of from 15 to 20 miles an hour, whilst our drift to the westward, would not exceed $3\frac{1}{2}$ miles in the same time; so that every point that the wind drew round toward the south, would tell us as plainly as if a map of the whole operations were suspended in the heavens over-head, for our consolation, that our exit from the commotion was rapidly drawing nearer and nearer; and that, if the ship proved equal to contend with the *crisis*, and no vibration occurred, we should escape the centre.

This may sound, in the style of the celebrated Francis Moore, of predicting memory, very like "taking a peep into futurity." We are not, however, studying the doctrine of probabilities. As far as we at present know of the matter, and (thanks to Mr. Redfield) we have gained a pretty general insight into it, there appear but two circumstances at all likely to upset our calculations and foresight of what is to happen, and these are, as intimated before, a divergency in the line of progression, or a vibration of the entire meteor; and here we are taught that, with all the wide and searching capacity of our minds, there is a point beyond which it is not permitted man to peer! We have been allowed, however, to glean enough of the economy of this most wonderful phenomenon to excite our unfeigned gratitude to Him 'who rules the whirlwind and the storm.' We proceed:—

On the other hand, if the shift of wind was to the N.E., or even a point on either side, we should immediately know that we were in the "very jaws of the lion;" and to escape being overwhelmed in the vortex, we must run for it.* On this occasion every moment is of importance, when we bear in mind that we are now in the path which the centre will follow. To the S.W., therefore, we start away, not without an impressive dread, as the wind comes veering round and round toward the north, of a too close approximation to the vortex, toward which the curve the ship makes inclines. If we could tell the exact diameter of the hurricane, and its precise rate of progression, we could calculate pretty accurately whether, and at what distance, we should pass the centre; but as these data can never be obtained, we have nothing, otherwise than *prudence*, to guide us in this particular case, the most perilous that can occur.

There is a very nice point to be determined upon at this juncture, and one, although there will be but a few minutes for decision, that should not be rashly settled; a sort of choice between the scalping-knife and the tomahawk; a very forlorn hope, take which measure you please, it is this: to scud under square sail, or to run with bare poles? Now, however desirable it is that top-sail should be carried in a storm where the waves rise to a great height, and break in heavy surf, and a ship's way is lessened as she drops into the trough, to prevent her from being pooped, yet, we say, although it should be practicable to set a close-reefed main-top-sail, the propriety of so doing is questionable until the wind has drawn round to the westward of north, (and then it might as well be left alone), for not before that will the dreaded centre have been passed; and as there can be no certainty of a ship's safety until that "consummation" has been accomplished, the chance of being taken aback with square sail deserves the most serious consideration of the commander. The danger in both cases is imminent, but in determining for ourselves, we should run with bare poles, until finally thrown out of the storm. Indeed, after all the judgement,

* When the line of progression is to the W.N.W. (a direction which some of the more southern storms have pursued) it would be wrong to scud with the wind at N.E.; but when at N.N.E., it would be proper to do so.

care, anxiety, and apprehension, which may be displayed and felt on so trying an occasion, our approximation, notwithstanding the vessel's *dash* of 12 or 13 knots, may be so near the vortex as that every stick shall be blown out of her. And we impressively declare our conviction that hitherto the majority, if not all, the vessels that have been lost in hurricanes and tyfoons, have foundered by falling into the centre with square sail set whilst scudding. On lying-to, no sail would stand the disruptive puffs for five seconds!

We have ourselves, in utter ignorance of the operations as they occur, and are here stated, been scudding in a frigate, (partly dismasted) with reefed *main-sail* (the only sail available) before the furious blast of a hurricane, after the wind had veered to the S.E. As it happened, we had fortunately dropped into the second quadrant, and were drawing near our exit, but we knew nothing of that, and if it had happened in the fourth quadrant, and we had got into the centre, there is no doubt but that the ship must have foundered! But, to proceed:

No other resource is available to us under such circumstances as described above; and no other alternative remains except the desperate one of heaving-to, defying the fury of the storm, and taking the chance of being thrown directly into the centre of commotion; where, if the ship should not founder, she would, there is scarcely a doubt, lose her masts, and be otherwise completely assailed at all points by the raging elements!

The N.W. verge of the hurricane, whilst it advances in that direction, is the "very head and front" of the danger, the nucleus of which follows, in a direct line, the advance of that point. The consequences, be they the foundering of the ship, or the loss of her masts, &c., are inevitable, if prompt and active measures are not taken to get out of that position.

Should the wind, at first, keep steady at E.N.E. for some time, which it would do (if the storm is of great extent) when a ship enters under the N.N.W. verge, the navigator may be a little puzzled how to act, as anticipating a shift, to determine his position; he need be under no apprehension, the shift will come in due time (according to the extent of the circumference) from the E. by N., and so gradually round, (but quickening as he approaches the centre) to the southward: he may, however, expect to lose some of his spars when the *crisis* arrives.

We have dwelt longer upon the action of the wind in the fourth or N.W. quadrant, because under this anterior verge the greatest peril may follow; and we may now be permitted to express a hope that mariners may derive some little advantage from the perusal of this paper, as the writer has devoted his best attention to the subject with the sole view of rendering them, as brother sailors, a service.

JOHN EVANS.

HURRICANE at *Antigua*, in 1835.—To the description of previous hurricanes we now add one of the hurricane at *Antigua*, in August, 1835, from the pen of our respected friend, *Lieut. Bisschop Greevelink*, of the Dutch Royal Navy.

"During our stay in English Harbour, we were visited by one of those unwelcome guests which always leave deplorable marks of destruction behind them; and as I am of opinion that their prognostics and operations cannot be too frequently described, I here give the following particulars of those which I had an opportunity of observing at *Antigua*.

"On the morning of that day in which this hurricane happened, the sun rose as beautifully as ever; a clear expanse and a gentle breeze gave reason for expecting fine weather. At about eleven the heat became rather oppressive, the last breath of wind died away, and the trees hung their branches and dropped their parched leaves. At twelve, when just returning from a walk in the country, there appeared in the east a huge mass of clouds, of immense extent from north to south, emerging from behind the hills which surround English Harbour. Slowly they moved onward, spreading darkness beneath their black columns, while the silence of the grave reigned below; the water became agitated, and 'deep sounds and deeper still' began to 'howl from the mountain's bosom,' but yet there was not a breath of wind to be felt.

"In about ten minutes, the border of the cloudy vault had reached its zenith, when it discharged a shower of rain, and, involving us in the shade, continued its course to the west: every living object now seemed well aware of what was pending; the birds hovered round in anxious speed, and they all hastened to their place of shelter.

"This

" This occultation lasted for a most solemn half-hour, till it had reached the western horizon, when suddenly the hurly-burly began. Wind from the northward, with a brisk gale, gradually increasing; the breaking of the waves against the coast, and in the mouth of the harbour, redoubled its fury, and seemed to work by certain hidden powers from beneath, as the foam was thrown up to a height of more than a hundred yards, without the surface of the water being pressed on by the wind.

" At three *p.m.* it blew a complete storm; the clouds, which bore a dismal gray appearance, and flew in the same direction as the wind, rolling and tumbling over each other in rapid motion, produced only weak glances of lightning; but not a single flash or thunder-stroke was observed during the whole event. An hour afterward the wind veered to the northwest, still increasing in force, while the whole atmosphere became thickened as with vapour, and twilight dimmed every remote object. Between five and six the wind shifted again to the west and southerly, at first wavering and as if reluctant, but, soon fixed in that quarter, it blew with redoubled force, pouring forth torrents of rain: at the same time the progress of fleeting aërial volumes was obstructed in the south-east, where they gathered into one thick body, emitting continual glarings of lightning, and just enabling us, from time to time, to get a faint view of ghastly figures flying onward with most amazing speed, until they had formed a compact mass of electric matter sufficient to counteract the force of the south-westerly wind, and to destroy, perhaps, many a mortal hope.

" At about seven these collected clouds loosened from the south, and half an hour afterward from the south-east, raging with almost irresistible violence, which I shall not attempt to describe: I will merely add, that the heavens and the earth were now literally mingling; two of our heavy ground tackle and a chain broke at once, and the ship grounded in 9 feet of water, most happily on a bottom of soft mud. At half-past eight, the wind had reached its highest degree of strength, which it retained for only half an hour, soon after diminishing; so that at eleven o'clock, nothing more than a common trade-wind was felt. The moon, then full, showed again her broad face, as if in mockery, and the clouds, now separated, drove off in squalls of thunder and lightning.

" From this hurricane we may make the following conclusions:—In the first place, that it arose during one of the principal phases of the moon, as also that it came from the eastward: and by accounts from other islands, we observe its course to have been to the W.N.W., and very narrowly limited in its breadth; as, at the time of its devastating the plains of Antigua, not the least trace of its existence was observed in the islands of Guadeloupe, Montserrat, or Barbuda; and again on its raging over St. Kitt's, nothing was felt at St. Martin's; thus these storms may be avoided by running to the southward or northward, which was, in fact, attempted and effected by the British steam-packet, *Spitfire*. The manner in which the wind changed its direction is also worth noticing, as it teaches mariners (should they ever go round the same way), when unable to gain the limits of its extent, and thus be compelled to withstand its fury, to put the ship's head off the wind, upon the starboard side, so as to prevent the wind's shifting from under the lee-bow, while lying-to."

N.E. COAST OF THE MEXICAN SEA.—On the last day of *August*, 1837, a hurricane nearly destroyed the town of *Apalachicola*, in Florida. Nearly every house was unroofed, and many were levelled. The storm commenced in the afternoon of the 30th, but was not severe until the morning of the 31st, and continued very violent until 7 *a.m.* The wind from S.E. to N.

In this storm the town of St. Mark was destroyed, the lighthouse being almost the only building left standing; yet the town of St. Joseph, to the West, suffered very little. At sun-rise, in the morning of the 31st, the wind at St. Mark's was from N.E.; at 8 *a.m.* it was north, and had increased in violence. Only one wharf was left standing. At the light-house the sea rose 8 feet higher than usual. The wind was from shore at the time of the storm; but it is supposed, while the N.E. wind prevailed on shore, that there was a south-easter at sea; a frequent case, which invariably produces a high tide.

At *Pensacola*, to the westward, there was no wind; and at *Kay West*, on the Florida Reef, there was a calm.—*American Papers*.

The "*American Journal of Science and Arts*," vol. xxxv. contains the paper noticed in page 118, entitled "On the Courses of Hurricanes; with notices of the Tyfoons of the China Sea and other storms; by W. C. Redfield, Memb. of Conn. Acad. of Arts and Sciences, Corr. Memb. of U. S. Naval Lyceum, the Albany Institute, &c." In this disquisition the principle previously admitted is more fully confirmed, and the striking uniformity

uniformity of preceding results verified : and here it is observed that the inductions have been usually on the theory of an *exact circle* in the course of the winds, which, in large storms and for practical purposes is, in most cases, sufficiently accurate. But it sometimes happens that the higher portions of the storm overrun the inferior portions, and reach the surface in advance of the main storm; thus presenting the wind, for a few hours, in a direction not accordant with that exhibited by the main body of the storm. It may also be added that, in the most violent of these storms, it is at least probable, if not certain, that the course of the surface wind is spirally inward, approximating gradually to the centre of the storm.

“At stations within the tropics, the changes of wind, during the passage of the hurricane, are sometimes known to *exceed* those which pertain to the passage of a regular circuit of wind; these changes sometimes running through the entire circuit of the compass and even more. Again, they have been known to shift *backward and forward*, in alternate and fitful changes, when near the crisis of the storm. These phenomena, so far from disproving the rotative character of these gales, only prove something more, and afford, at least, probable evidence in support of one or both of the following positions, viz. 1. That high land and other obstructions often produce sudden and fitful gusts and changes in these violent winds. 2. That, in accordance with our observations of minor vortices, the axis of rotation is often impelled, excentrically, around a smaller circuit, in the interior of the advancing storm.

“In the northern intertropical latitudes the recession or departure of the south-eastern limb of the storm appears to be followed, not unfrequently, by strong squalls or gusts from S.E., this being the true course of the general trade wind that determines the track of the storm. These gusts or squalls, if mistaken for the regular action of the hurricane, may occasion erroneous deductions in regard to the course of the storm.

“At stations apparently within the regular track of the storm, there will sometimes be an absence of violent wind; or the violence will pertain to only one of the phases, which the storm presents, in its regular course over such locality.

“Some storms are interrupted in their development by the near approach of another storm. Care must be taken therefore not to mistake the N.E. wind of a storm whose north-western limb is thus intercepted by a bordering storm, and which hence is sometimes followed by the natural current of air from the S.W. quarter, for the changes that pertain to the centre of the gale.”

Mr. Redfield says, in conclusion, “The courses and developments of the storms which pass over the island of Great Britain are believed to be more complex than on the shores of the United States. It is not improbable that the course of many European storms is in a south eastern direction. A comparison of marine reports has shown me that, while a storm was blowing at West or W.S.W. in the English Channel it was blowing S.E. at Elsinure; at N.E. on the East coast of Scotland; and at North and N.W. in the Irish Channel; thus exhibiting, plainly, a rotation to the left: but it is on careful investigations, hereafter to be made, that we must rely for a proper development of the system of European storms.”

The memorable hurricane of the British Islands, which occurred on the 28th of October, 1838, has been described from various reports dated from Plymouth, Dublin Bay, Orkney Islands, Bristol, Aberavon, Hull, Harwich, and Dover, as shown in the *Nautical Magazine* of February, 1839. Its progress, says the Editor, affords a good practical illustration of the ‘Redfield theory,’ as it was insisted in most respects to those of the West Indies, excepting in excessive violence.

We have exceeded our intended limits on the subject of hurricanes, but its importance precludes apology. To those who desire more and better information we recommend not only a close perusal of the disquisitions which have been quoted, but all others given in the ‘*Nautical Magazine*,’ &c. The valuable periodical last mentioned contains a series of papers and tracts upon the subject, which may be taken up in order as follows:—

January, 1836;—Remarks on the Atlantic Hurricanes in general. *March*, 1836;—An impressive description of the *Centaur’s Hurricane*, 29th and 30th July, 1805. (See note, page 115.) *April*, 1836;—Mr. Redfield’s tract, with the Routes No. I. to X., which have been described in pages 118, 119. *January*, 1837;—Atlantic Hurricanes in general, and Hurricane of the British Isles, on the 26th of November, 1836. *March*, 1837;—Atlantic Hurricanes, continued. *April*, 1837;—Theory for avoiding Hurricanes, as explained by Lieut. Evans, in the preceding pages, with a list of the principal ones during the last 123 years.

years. *December*, 1837;—Additional particulars of the British Hurricane of the 29th of November, 1836.

In the number dated *January*, 1838;—Hurricanes of the 26th of July, and 2nd of August, 1837. *July*, 1838;—Hurricane experienced by the ship *Feliza*, from Jamaica to Bristol, 18th, 19th, and 20th of August, 1837; with remarks and questions for the consideration of those who encounter hurricanes and typhoons. *January*, 1839;—Mr. Redfield's latter tract on the courses of Hurricanes, noticed in page 118; also descriptions in detail of the hurricane over the Bahamas, &c. 6th of September, 1838. *March*, 1839;—A re-examination of the Raleigh's Typhoon, by Lieut. Evans. *July*, 1839;—Additional facts on the Raleigh's Typhoon, collected by Mr. Redfield. *December*, 1839;—"On the barometer at sea, and the ill effects of scudding in a hurricane, by Mr. J. Marshall."

With the above should be included the disquisition of Colonel Reid, as read to the meeting of the 'British Scientific Association,' on the 20th of August, and of which a report may be found in the '*Athenæum*,' No. 565, August 25, 1838.

STORM on the FLORIDA STREAM in 1827.

WE shall conclude this division with the following singularly interesting narrative, originally communicated to the *Liverpool Commercial Chronicle*, and dated Ship *New York*, Prince's-dock, Liverpool, May 11, 1827.

"I trust that, although a stranger, I shall find a sufficient apology, in the very uncommon nature of the occurrences herein described, for troubling you with the detail of the following particulars. This ship has been twice struck by lightning on her present voyage from New York. On the 19th of April, our third day out, in the Gulf Stream, (lat. $38^{\circ} 9' N.$, long. $61^{\circ} 17' W.$ at noon,) about half-past five in the morning, being in our berths, we were roused by a sound like the report of heavy cannon close to our ears. In a moment we were all out, and the cabin and all parts of the ship were filled with a dense smoke, having a strong smell of sulphur. From the deck the word was quickly passed that the ship had been struck with lightning and was on fire. The consternation which for some minutes prevailed may be more easily imagined than described. Every one ran on deck with a full impression that the ship was in a blaze. There all the elements were in violent commotion. It had been broad day, but so dark, so dense, and so close upon us, were the clouds, as to produce almost the obscurity of night. There was just sufficient light to give a bold relief to every object in the appalling scene. The rain poured down in torrents, mingled with hail-stones as large as filberts, which lay upon the deck full an inch thick. Overhead blazed the lightning on all sides, accompanied by reports almost simultaneously, thus evincing its nearness. The sea ran mountains high, and the ship was tossed from one sea to another with incredible rapidity. One appearance was peculiarly remarkable. The temperature of the water was at 74° deg. of Fahrenheit, while that of the atmosphere was down to 48° ; a difference of 26 degrees. This produced a copious evaporation, and caused immense clouds of vapour to rise, which, ascending in columns all around us, exhibited the appearance of innumerable pillars supporting a massive canopy of clouds. These phenomena are extremely unusual, no person on board ever having witnessed any thing like it before. In all directions might be seen waterspouts, which, rising fearfully to the clouds, seemed actually to present to the eye a combination of all the elements for the destruction of every thing on the face of the deep. Altogether the scene was one of awful sublimity, which baffles description. Amid this scene of impending ruin, when all nature was in the utmost confusion,—when nautical science and experience could avail nothing,—while an irresistible element was playing about us, and the ship seemed on the very verge of fate,—when, in short, dismay and despair were reflected from every other countenance,—nothing could exceed the calm tranquillity of Captain Bennett,—nothing could excel the firmness with which every order was given, for examining the ship, in prospect of meeting fire below deck,—nothing could equal the manner in which every one was encouraged with the hope of security, even beyond what in reason could be expected. Thus I but echo the sentiments of all on board.

"But I hasten to my narrative. Some parts of the ship and spars were for a moment on fire, but were quickly extinguished by the rain. The ship was then, though roughly, examined, to ascertain whether the electric fluid had penetrated among the combustible part of the cargo below the lower deck. This investigation disclosed the following facts:—The lightning, having struck the main royal-mast head, shattered the mast-head, and, descending thence,

thence, penetrated the deck into one of the store-rooms, the bulkheads and fittings of which were completely demolished. Then separating, one part was conducted by a leaden tube to the side of the ship, through which it passed out between wind and water, starting the ends of three five-inch planks. Another portion from the store-room passing into the ladies' cabin, shivered to atoms the plate of a large mirror, leaving the frame uninjured. From the looking-glass to the piano-forte was an easy transition; it touched the instrument with no delicate impulse, dismounting it, and leaving it out of tune. Thence it passed through the whole length of the after-cabin, and out at the stern windows. Fortunately, we were all in our berths at the moment. Upon these facts I would venture briefly to remark, that the mast-head was bound by four iron hoops, say from two to three inches wide, and nearly half an inch thick. These attracting the fluid, and being themselves insulated by other less powerful conductors, would naturally at the instant accumulate a large repletion of the fluid, which, by the violence of its action, burst the hoops asunder, and shattered the mast-head and cap. Into the cabin store-room it seems to have been conducted by a leaden pipe near the mainmast under the deck. The quicksilver on the back of the mirror was sufficient to attract it thither, when it would be diffused over the whole surface of the glass, which, being the most perfect non-conductor known, was thus shattered into countless pieces. The atmosphere being very moist, the dampness of the cabin floor, from want of a better conductor, might probably aid in carrying it to the windows.

"Being all in our berths, enveloped in beds and bedding of non-conducting materials, we reposed in comparative safety, while the deadly bolt careered around us with fierce and resistless energy. Doubtless a feather bed is the most safe retreat in such cases. Had it been later in the day, and the passengers about the cabin, the chances are, that it would have been fatal to many of us.

"The operation of the second shock was very different from the former, and is more deserving of attention, as furnishing a new instance in proof of the efficacy of lightning-rods as a protection at sea. We had a chain conductor on board; but it not being the season to expect much lightning, and the first shock coming on quite suddenly, it was not up at the time. The morning squall was over; it continued, however, to blow fresh all the day, and about noon heavy clouds began to gather in on every side, rolling their volumes apparently among the rigging. We had reason to expect more lightning; the conductor was prepared, and Captain Bennett ordered it to be raised to the main royal-mast head. It consisted of an iron chain, having links one-fourth of an inch thick, and two feet long, turned in hooks at each end, and connected by rings of the same thickness, and of one inch annular diameter. This chain was fastened to a rod of iron, half an inch thick and four feet in length, with a point well polished and tapered, in order to receive the fluid with facility; it was secured to the main royal-mast, the rod extending two feet above the mast-head, and thence it was brought down over the quarter, and repelled by an oar protruding, say ten feet, from the ship's side, sinking a few feet below the surface of the water.

"Dr. Franklin was of opinion that a rod of this size would sustain without injury the severest shock of lightning. I have been thus minute in stating the dimensions of the chain, for the double purpose of conveying some idea of the force of this shock, and of impressing the necessity of providing larger conductors. The chain, however, in this instance performed its office, and it was up in happy time to avert a blow that, in the opinion of all on board, must have sent this stanch vessel in an instant to the bottom.

"Soon after one *p. m.* we saw lightning: a little before two observed a very smart flash; looking at my watch, which marks seconds, I counted four, when the report followed; I felt no alarm, however, having frequently known it to approach nearer without any injury. At two o'clock we were astounded by another shock like that in the morning: the flash and sound simultaneous. I happened to be in the cabin with another passenger: a ball of fire seemed to dart down before us; at the same moment the glass in the round-house came rattling down below. Those on deck agreed that the whole ship appeared to be in a blaze, from the vividness of the principal flash, which they distinctly saw darting down the conductor, and agitating the water. All parts of the ship, as before, were filled with smoke, smelling of sulphur.

"The ship was again thoroughly examined. The conductor had been rent to pieces by the discharge, and scattered to the winds; small fragments of it were found on deck; in saving the ship, it had literally yielded itself to the fury of the blast. The pointed rod was found to be fused and shortened several inches, and covered over with a dark coating; some of the links had been snapped off, and others melted. The whole operation was singularly striking,

striking, and affords another of those rare cases where the conductor yielded to the violence of the shock, while it effectually averted the bolt from the object it was designed to protect.

"This was a property of the rod, of which Franklin was satisfied very early after the application of a theory that has disarmed the lightning of Heaven. One of the earliest cases which fell under his notice, I believe, occurred in one of the Dutch churches in New York: a chain connected with the clock, probably saved the church much damage, but the chain itself was melted.

"Mr. Ross, the second officer, was prostrated, and three of the men struck, but none much injured. It affected the polarity of all the compasses, causing them to vary from the true point and between each other. They gradually assumed a bearing, by which we have steered, though still three points out, as we have just discovered. The captain's chronometer was very materially affected; it usually crosses the Atlantic without varying three seconds; it has now proved to be out as many degrees. Curious as are these effects, they are still more interesting in an experimental view. Such facts, carefully noted down at the time, afford useful *data* in the cause of science. Thus collected, they are at your disposal. When it is considered that not one vessel in fifty is prepared with a conductor, cases of this kind ought to admonish ship-owners of their utility. Captain Bennett is determined to go well armed with them in future. It would be well to have one ready to be raised at each mast, in case of emergency; and, for the safety of the chain, it ought to be half an inch in diameter."

"We have visited," says the editor of the *Liverpool Chronicle*, "the ship since her arrival, and the traces which remain of the operation of the first shock, together with the concurrent testimony of Captain Bennett and his mates, and the state of the iron rod, and such portions of the chain conductor as have been preserved, which, for the present, may be seen on application at our office, have served to convince us of the general truth of the foregoing letter, and of the singular good fortune attending the timely application of this simple but philosophical invention of the admirable Franklin, which no ship should be without. Many additional particulars were recounted to us by Captain Bennett, which the pressure of other matter, and the shortness of the time remaining to us, prevent us, at present, from repeating. The following circumstances, however, communicated to us by Roskell and Son, chronometer-makers, in Church-street, are too interesting to be passed over. Captain Bennett's chronometer, after observing, for a considerable length of time, a uniform rate of 7-10ths of a second gaining, and, being nine minutes forty-two seconds slow of Greenwich time, when the vessel left New York, was found, when compared in Liverpool, to be 24 minutes 33 seconds fast of Greenwich; and three lever gold watches, belonging to three gentlemen, passengers by the ship, contracted the magnetic power to such a degree as actually to require the principal part of the steel work to be renewed.

"Such is the effect," observes a correspondent, who has transmitted us the above account, "produced on the steel work in the watches, that they have the power of the magnet so far, as to act the same as the loadstone."

Some additional Remarks on this case will be found in the APPENDIX, hereafter.

Another singular case, too remarkable to be omitted, occurred in the destruction of the ship *Sir Walter Scott*, Captain Clarke, off the eastern border of the Gulf Stream, in 1835. This ship sailed from New Orleans on the 21st of May, with a cargo of cotton, a lady and two other passengers, bound for Liverpool. In coming down the Gulf-Stream the vessel encountered a heavy gale from S.W. The sea ran 'mountains high.' On the 21st of June, at about 8 a. m. in latitude $31^{\circ} 24'$, long. $75^{\circ} 43'$, when under double reefed topsails, and bearing upon the wind, nearly on the parallel of Charleston, a heavy peal of thunder broke over the ship, and it seemed as if the heavens had been rent asunder. The electric fluid had struck the foremast, ran into the fore-castle, where the seamen were at breakfast, dashed every thing to pieces, sent the men sprawling in all directions, and completely raked the vessel fore and aft, and between decks and in the hold. The seamen were almost struck senseless by the shock, but in a few minutes the cry of fire aroused them to a new sense of danger, and the lady, Mrs. Hamilton, was the only one, besides the captain, 'whose courage rose up to meet the danger with *promptitude and energy*.' In six or eight minutes after the lightning had struck, every part of the cargo was on fire. The thunder-struck men, under the order of the captain, cleared out the long-boat, launched the gig, and then swung down the boat into the boiling ocean below. The lady was first put into the long-boat, while the ship was rolling tremendously; the flames bursting forth in all directions, and her masts tottering to the gale. The moment the long-boat and the gig left the

the burning vessel, her masts fell by the board; and, in about 50 minutes from the first stroke, one long sheet of flame covered the wreck: the *Sir Walter Scott* was seen no more. The captain, crew, and passengers, were happily taken up next day by the ship *Saladin*, and conveyed to Norfolk in Virginia.*

From what has been said upon the nature and progressive course of hurricanes, the risk of proceeding, at certain times, through the Gulf-Stream, must be clearly seen; and the recital of the facts which have been adduced show the propriety of proceeding toward Europe by the southern parallels, as will be shown hereafter.

WATERSPOUTS.

The well-known phenomenon, called a **WATERSPOUT**, which is frequently seen on the Atlantic, proceeding from black dense clouds, always appears in warm weather, generally in calms, or with little wind; but they have been seen during a fresh gale. It has been shown, by the celebrated Dr. Franklin, and other writers, that a whirlwind on land, and a waterspout at sea, arise from the same general causes; and may be considered as one and the same. At sea they are commonly harmless, unless ships happen to be immediately under them; but if, in the progressive motion of the whirl, it passes from the sea over the land, and there suddenly breaks, violent and mischievous torrents are the consequence. At sea, after the spout breaks, the water descends in the form of very heavy rain. In the vicinity of a spout, the wind commonly flies round in sudden gusts; and all ships should therefore take in their square-sails.

That a waterspout and whirlwind are identical, has been amply demonstrated by those who have seen this meteor pass from the sea to land, and the contrary. They have both a progressive as well as circular motion; they usually appear after calms and great heats, and mostly happen in the warmer latitudes.

Marine waterspouts, therefore, are caused by the action of atmospheric currents. Malté Brun thus describes them:—"Underneath a dense cloud, the sea becomes agitated with violent commotions, the waves dart rapidly toward the centre of the agitated mass of water, on arriving at which they are dispersed into aqueous vapours, and rise whirling round, in a spiral direction, toward the cloud. This conical ascending column is met by another descending column, which leans toward the water, and joins with it. In many cases, the marine column is from fifty to eighty fathoms in diameter near its base. Both columns, however, diminish toward the middle, where they unite; so that here they do not extend more than three or four feet in diameter. The entire column presents itself in the shape of a hollow cylinder, or tube of glass, empty within. It glides over the sea without any wind being felt; indeed, several have been seen at once following different directions. When the cloud and the marine base of the waterspout move with unequal velocities, the lower cone is often seen to incline sideways, or even to bend, and finally to burst in pieces. A noise is then heard, like the noise of a cataract falling in a deep valley: lightning frequently issues from the very bosom of the water-spout, particularly when it breaks; but no thunder is ever heard."

In order to prevent the danger which a vessel would be exposed to by coming in contact with these tremendous columns, it is the practice to discharge upon them a cannon ball, which, passing through them, causes them to burst, and consequently removes all chances of injury connected with them. This phenomenon is accounted for in the following manner:—"Two winds meet—a vortex ensues: any cloud which happens to lie between them is condensed into a conical form, and turned round with great velocity: this whirling motion drives from the centre of the cloud all the particles contained in it; a vacuum is thereby produced, and water, or any other body lying beneath this vacuum, is carried into it upon the usual and well-known principle. The cannon ball, breaking this cylinder, which is always partly hollow, causes it to fall to pieces, in the same manner as a touch upon the surface of a bubble reduces the resplendent mass to a drop of common water.

* Abridged from the very interesting and original account, given in the 'United States Gazette,' and repeated in the London weekly papers of Sept. 20, 1835.

The following description of a **WATERSPOUT**, seen during a fresh gale, upon the coast of North-America, was written by the late Mr. Murdo Downie.

“ Upon the forenoon of the 9th of October, 1795, while cruising in His Majesty’s ship, *Resolution*, of 74 guns (then bearing the flag of the late Admiral Murray), in company with *H.M.S. Africa*, of 64 guns, commanded by the late Admiral, then Captain, Home, in latitude 32° , and longitude $66\frac{1}{2}^{\circ}$ W., having the wind at N.N.E. blowing a fresh gale, and the ship steering by the wind east for the islands of Bermudas, we were surprised with a waterspout, formed in an instant, directly to leeward, at about two miles, or little more, distant. Both the *Africa* and we fired several 18-pound shot at it, which fell a little short; and, although some of the shot fell very near, yet they had no visible effect upon it. Its appearance was that of a long slender pillar, with the upper end spreading into a large dense cloud, of which it seemed to form a part, and the lower end reached to within about 20 or 30 feet of the sea, where it was obscured from the sight by the water’s being violently thrown up and agitated, so as to resemble a number of fountains or water-engines playing perpendicularly round the lower end of the spout. The pillar became more transparent in proportion as it decreased in size from the cloud downward, until at the lower end, where it was almost perfectly so; and a small column, of an equal diameter, and more transparent than the rest, appeared up through the middle, so that about the lower end it resembled an empty glass tube in appearance, from thence the transparent column in the middle became gradually obscured, the higher up, by the opacity of the outside, until it altogether disappeared near the cloud. The spout appeared at its full size, or nearly so, when first seen, and began to decrease shortly after, and turning gradually smaller, it in a short time vanished in a slight shower.

“ We were too intently gazing at this extraordinary phenomenon to mark the exact time it lasted, but supposed it to continue 10 or 15 minutes; and its distance from the ship was pretty accurately ascertained by the shot fired at it nearly reaching; but, what appeared most remarkable was, that, although the wind blew so strong a gale, that the ship could carry only reefed topsails (from which the velocity of the wind cannot be estimated at less than 30 or 40 miles an hour), yet the waterspout seemed to move but very little from the place where it was first seen. The ship was going at the rate of $5\frac{1}{2}$ miles an hour, and increasing her distance from the spout; yet, after continuing the above-mentioned time, it was considerably within the verge of the visible horizon, as seen from the quarter-deck, when it vanished (as upon the quarter-deck the eye was elevated 23 feet above the surface of the sea, the horizon would therefore be seen about 6 miles distant): now, allowing the ship to have increased her distance from the spout half a mile during its continuance, and that it vanished a mile within the verge of the visible horizon, which, together with two miles it was distant when first seen, will make in all $3\frac{1}{2}$ miles, which, taken from 6 miles (the distance of the visible horizon), leaves $2\frac{1}{2}$ miles for the spout to move in 10 minutes; whereas the wind must have gone at least 5 miles in that time, and consequently $2\frac{1}{2}$ miles faster than the water-spout. Indeed it is very probable the waterspout did not move so much, in proportion to the wind, as the above calculation gives the least difference between their motions that could have been allowed from the observations: the intention of this calculation being principally to prove that the waterspout in some measure resisted the force of the wind.

“ I have always observed, that waterspouts, lightning, and other electrical phenomena, are far less frequent toward the middle of the ocean than they are upon the land, or near it; and when they happen upon the sea, the cloud that contains them is generally observed to have come from off the land; from which reason we find that electrical phenomena are more frequent, and are found to reach to a greater distance, upon the sea bordering the east coast of North America, than upon that bordering the west coast of Europe, because of the prevailing westerly winds carrying the clouds charged with electric fluid off the land upon the sea near the American coast; whereas upon the European coast these winds confine the clouds upon the land. It is also a known fact, that, within the limits of the N.E. trade-winds, and half-way between the Cape Verde and Windward West-India Islands, more especially in the latitude of these islands, scarcely any of these electrical appearances ever happen; whereas upon the shores of Africa and America, in the same climate, they frequently rage with great fury.”

DESCRIPTION OF WATERSPOUTS by the late MR. GEO. MAXWELL.

“ There can be no doubt that waterspouts have, in most cases, been accompanied with electrical phenomena; and it is equally certain that the spiral and ascending motion of the water

water has been produced by a gyratory movement in the air, arising from the meeting of two opposite winds. Mr. Maxwell had opportunities, during several voyages to the Congo, of frequently witnessing this interesting phenomenon, and in a drawing, from which the subjoined figure has been made, he has represented the different states of a water-spout, as they most commonly occur.



At their first formation, Mr. Maxwell says, they appear as at A, where the black cloud drops from a level surface into a conical form, before the disturbance at the surface of the sea, as shown at D, is observed. The effect produced at D is like that of a smoking furnace. The black conical cloud now continues to descend, as shown at B, till it almost reaches the surface of the sea, and the smoke-like appearance rises higher and higher, till it forms an union with the cloud from which the spout appears to be suspended. In this condition it is said to put on its most terrific appearance to the mariners who have the misfortune to be in its neighbourhood. When the spot begins to disperse, it assumes the appearance shown at C. The black cloud generally draws itself up in a ragged form, but leaves a thin transparent tube, C E, which reaches to the water, where the smoke-like commotion still prevails. Mr. Maxwell observed, at this time, in the upper part of the tube, a very curious motion.

This singular fact, of the existence of a transparent tube, confirms a description, by Mr. Alexander Stewart, of water-spouts which he saw in the Mediterranean, in 1701. "It was observable of all of them, but chiefly of the large pillar, that toward the end, it *began to appear* like a hollow canal, only black in the borders, but white in the middle; and though, at first, it was altogether black and opaque, yet one could very *distinctly perceive* the sea-water to fly up along the middle of this canal as smoke does up a chimney, and that with great swiftness, and a very perceptible motion; and then, soon after, the spout or canal burst in the middle, and disappeared by little and little; the boiling up and the pillar-like form of the sea-water continuing always the last, even for some considerable time after the spout disappeared, and perhaps till the spout appeared again, or re-formed itself, which it commonly did in the same place as before, breaking and forming itself again several times in a quarter or half an hour."—*Phil. Trans.* 1702.

Captain Horsburgh, in his description of waterspouts, has said, "When a whirlwind or waterspout is observed forming at a distance, a cone may be perceived to descend from a dense cloud in the form of a trumpet, with the small end downward: at the same time the surface of the sea under which it ascends a little way in the form of steam or white vapour, from the centre of which a small cone, proceeding upward, unites with that which projected from

from the cloud ; and then the waterspout is completely formed. Frequently, however, the acting cause is not adequate for this purpose ; and, in that case, after the waterspout is partly formed, it soon proceeds to disperse.

“ There is in the middle of the cone, which forms a waterspout, a white transparent tube or column, which gives it a very dangerous appearance when viewed at a distance, as it seems like a stream of water ascending ; but, when closely approached, the dangerous appearance partly vanishes. * * * * * The vacant space in the centre appears like a column of water when viewed at a distance, or like a hollow glass tube. In calm weather waterspouts generally have a perpendicular direction ; but occasionally also they have an oblique or curved direction, according to the progressive motion given to them by the prevailing winds. Sometimes they disappear suddenly, at other times they move rapidly along the surface of the sea, and continue a quarter of an hour or more before they disappear.

“ Waterspouts are seldom seen in the night, yet I once passed near to a large one in a cloudy dark night. The danger from them is not so great as many persons are liable to apprehend ; for it has been said that a large body of water descends when they break, enough to sink a ship. This does not appear to be the case, as the water descends in heavy rain where it is broken from the ascending whirlwind. But there is danger to small vessels of being upset when they have much sail out ; and large ships, if they have not their top-sails clued up and yards secured, may be liable to have them carried up to the mastheads by the force of the whirlwind, and thereby they may lose their masts.

“ When a whirlwind happens on land, all the light substances are carried up in a spiral motion by it. I have observed one pass over Canton River, in which the water ascended like a waterspout at sea, and some of the ships that were moored near its path were suddenly turned round by its influence. After passing over the river it was observed to strip many trees of their leaves, which, together with the light covering of some of the houses and sheds, it carried up a considerable way into the atmosphere.”

Captain Wm. H. Smyth, in his interesting volume on Sicily and the Sicilian Islands, has noticed that “ waterspouts and various singular meteoric phenomena occur in that neighbourhood. Among the latter, on a warm, cloudy, and hazy day, the 14th of March, 1814, it began to rain in large drops, that appeared muddy, and they deposited a very minute sand of a yellowish red colour. The wind, on the day before, had been blowing strongly from the S.S.W. to the N.E. ; and, during the time the rain fell, was from the S.W., which leads to a supposition that it was transported from the Deserts of Africa.” This remark accords with a number of others on the sand from the *Sahara* or *Desert*, which is carried by the wind over the Atlantic, to an almost incredible distance from the western coast.*

To the preceding descriptions we now annex another, as given by the Honourable CAPTAIN NAPIER, R.N., F.R.S.E., in 1814.

“ On the 6th of September, 1814, in latitude $30^{\circ} 47' N.$, and longitude $62^{\circ} 40' W.$,† at 1 h. 30 m. *p.m.*, the wind being variable between W.N.W. and N.N.E., the ship steering S.E., an extraordinary sort of whirlwind was observed to form about three cables' length from the starboard bow of His Majesty's ship *Erne*. It carried the water up along with it, in a cylindrical form, in diameter, to appearance, like that of a water-butt, gradually rising in height, increasing in bulk, advancing in a southerly direction, and, when at the distance of a mile from the ship, it continued stationary for several minutes, boiling and foaming at the base, discharging an immense column of water, with a rushing or hissing noise, into the overhanging clouds ; turning itself with a quick spiral motion, constantly bending and straightening, according as it was affected by the variable winds, which now prevailed from all points of the compass. It next returned to the northward, in direct opposition to the then prevailing wind, and right upon the ship's starboard beam, whose course was altered to East, in hopes of letting it pass astern. Its approach, however, was so rapid, that we were obliged to resort to the usual expedient of a broadside, for the purpose of averting any danger that might be apprehended ; when, after firing several shots, and one, in particular, having passed right through it, at the distance of one-third from its

* Colonel Reid has given, in his “ Law of Storms,” a chapter (xi.) on “ Waterspouts and the smaller Whirlwinds,” with several beautiful figures of the same, which have been repeated in the “ Nautical Magazine,” of July, 1839.

† About forty-five leagues S.E. from the Bermudas.—Ed.

base, it appeared for a minute as if cut horizontally in two parts, the divisions waving to and fro in different directions, as agitated by opposite winds, till they again joined for a time, and at last dissipated in an immense dark cloud or shower of rain.

"The near edge showered in large heavy drops on the ship's deck, until the cloud was quite exhausted.

"At the time of its being separated by the effect of the shot, or more probably by the agitation occasioned in the air by the discharge of several guns, its base was considerably within half a mile of the ship, covering a portion of the surface of the water at least half a furlong, or 300 feet in diameter, from one extreme circumference of ebullition to the other; and the neck of the cloud into which it discharged itself appeared to have an altitude of 40° of the quadrant, while the cloud itself extended overhead, and all around, to a very considerable distance.

"Allowing, then, from the ship, a base of a little more than one-third of a nautic mile, say 2050 feet, and an angle of 40° to the top of the neck, we shall then have, for the perpendicular height of the spout, about 1720 feet, or very nearly one-third of a statute mile. A little before it burst, two other water-spouts, of an inferior size, were observed to the southward, but their continuance was of short duration.

"When danger was no longer to be apprehended, I observed the barometer, and found it at $30\frac{1}{16}$ inches, with the surface of the mercury very convex; an appearance which it had not assumed when at the same height at noon, about two hours before; the thermometer stood at 82° , having risen one degree since that time.

"During the continuance of the waterspout, and the subsequent rain, which might be a little more than half an hour, the wind blew from all points of the compass at different times, generally shifting at opposite points, never stronger than a fresh breeze for a moment, but in most instances quite light. It was unattended with any thunder or lightning, and the water that fell from the cloud was perfectly fresh.

"Having witnessed this extraordinary phenomenon, I endeavoured to ascertain its cause.*

"Although this phenomenon was rather terrific in appearance, yet I am not inclined to think it would have been attended with any serious calamity to the ship, had even the whole quantity fallen on board, allowing the loftier sails to have been taken in, the hatches battened down, and scuppers open. The cylinder or spout coming in contact with the masts and rigging, would naturally be destroyed; and the air rushing in, instantaneously, to restore the equilibrium, the torrent would be thus checked in its fall to the mere weight or force of a tropical descent. I have heard many reports of ravages committed by these aqueous meteors, but never yet met a person who had actually witnessed or experienced any such distressing effects."

NEW PROVIDENCE.—A remarkable Whirlwind occurred at New Providence in 1839, which was described as follows, by the Hon. J. C. Lees, in a letter dated Nassau, March the 8th:—

"The morning had been calm, cloudy, and sultry, with occasional light puffs of wind from nearly every quarter. At about 3 p.m. I happened to look at the weathercock on the gaol, and saw it turn *completely round* twice in a few seconds. Immediately afterward I heard a sort of rushing roaring noise to the S.E.; the noise was similar to the roaring when a large building is on fire. I had scarcely turned my eyes to the quarter, when I observed what, at first, I took to be smoke mingled with bushes, and I thought there had been an explosion of gunpowder: it must have been about a mile off. It advanced rapidly, however, toward me, being a column of dust and sand, intermingled with leaves and branches of trees ascending to a great height and revolving rapidly, as near as I can recollect, against or contrary to the course of the sun. It soon reached the town. The poor-house was partially injured, some small buildings raised up and knocked to pieces, trees torn up, walls knocked down, &c. There was no time to shut a window or make any preparation. A lemon tree near my house was *twisted* out of the ground; an open railed gate, made of very heavy wood, was taken off the hinges; and band-boxes, papers, and many light articles, flew out of the upper windows in *opposite directions*, as if some gunpowder had been exploded in the centre of the rooms.

* See Edinburgh Phil. Journal, Vol. VI. page 97.

"The whirlwind had travelled thus far from S.E. to N.W. : it then suddenly turned to a North or N.N.E. course, and passed down a street toward the harbour, apparently in either a serpentine or zig-zag course, knocking down every alternate house on each side of the street ;* it then destroyed a long store-house, and passed into the harbour. A brig of about 250 tons, with cargo discharged, was lying near the shore. She was thrown down on her side as it passed over her. The meteor passed too rapidly over the harbour to allow time for observation on the effect it produced on the water ; but, so soon as it passed over the narrow strip of land called *Hog Island*, which separates the harbour from the open sea, it formed a *Waterspout*, which passed off to the North or N.N.E.

"On looking at the houses which had been knocked down, I observed that the effect had been quite different from that occasioned by a common gale. The latter would have caused the walls, &c. to fall in *one* direction, but of these houses the four sides fell outward in four different directions, as if from an explosion within, or as I suppose they would have done from the expansion of the interior air, occasioned by a *vacuum* suddenly passing over them ; and this must also have been the cause of articles above alluded to flying out of opposite windows.

"There was, at the time, no barometer in the country, and I did not notice the height of the thermometer ; but as far as I can recollect, from my feelings, it must have been about 75° to 80°. I can account for the brig being thrown on her side by supposing that she was caught by one side of the circle of wind, and, being very light, was heeled over before she had time to swing across the tide to it. She was lying East and West, and careened over to the North. The whole meteor could not have been more than 50 yards in diameter to have passed down the street in the way it did, taking down every alternate house only. There had been thunder and lightning during the day, but not much. I have seen great numbers of waterspouts, far and near, and this resembled them."

II.—OF THE TIDES.

As introductory to a General Table of the Tides, we shall give a few passages from *M. Malté-Brun*, explanatory of the subject.

The water of the sea yields to the slightest impression ; and, although its density and weight combine to retain it in a constant equilibrium, it is agitated to a certain depth, by rapid and varied motions. These motions may be classed according to the manner in which the particles move, and according to the nature of the agents which cause the motion.

Three kinds of motion may be distinguished in the sea, considered in reference to their causes. The *TIDES* are *sideral motions*, because they depend upon the influence of the heavenly bodies. *General Currents*, and the greatest number of *Particular Currents*, have their causes in the very element that is agitated by them ; these then are *motions of the sea itself*. The third kind comprehends *atmospheric motions*, produced by the action of the winds.

In the water of the ocean we may distinguish three beds or strata, one above the other, but without any constant limit ; the first, agitated by the winds, is the bed or *stratum of undulations* ; immediately beneath this is the *stratum of currents* ; and lastly, beneath is the *immoveable stratum*, where the density of the particles from pressure, and from their adherence to the globe, and from friction, prevents all motion.

The motions of the air, or winds, produce corresponding motions on the surface of the water. Unequal and violent winds give rise to *waves*, which tower aloft like foaming mountains, roll, rebound, and dash against each other ; one moment they seem to bear on their surface the goddesses of the sea, who come to sport in the dance ; the next they are involved in the fury of the tempest, they appear to swell with rage, and present to the imagination the monsters of the deep, contending in wrath. A strong, constant, and equal wind, produces long ridgy *waves*, which all rise, as it were, with the same front, push forward with uniform velocity, and precipitate themselves, in regular succession, on the shore. Sometimes the waves, suspended by a gust of wind, or arrested by a current, form a kind of liquid wall, to the imminent danger of the navigator.

All these oscillations arise from a current of air, which, by dislodging a certain portion

* The houses are small and detached, about twenty yards apart from each other.

of the waters, has destroyed the equilibrium which, every moment, they endeavour to recover. These motions are similar to those of a pendulum, and they affect only the surface of the waters. The divers assure us that, in the greatest tempest, calm water is found at the depth of 90 feet.

We must distinguish the *waves* produced by the momentary action of the wind, and those which arise from the impulse communicated by a preceding wind, or by a current, or by any other cause. This double oscillation, which contributes to augment the agitation of a vessel, is often experienced.

THE TIDES are regular and periodic oscillations, which the seas undergo from the attraction of the celestial bodies, principally those of the moon and sun.

Action of the Moon.—Let us first consider the single action of the moon upon the sea; supposing that luminary to be in the plane of the equator. It is evident that, if the moon exerted upon all the particles of the sea an equal attraction, and parallel to the earth's centre of gravity, the entire system of the globe, and of the waters which cover it, would be influenced by a common motion, and their relative equilibrium would not suffer any change. This equilibrium is disturbed only by the difference between the attractions which the moon exerts, and the inequality of their directions. Some parts of the globe are *directly* attracted by the moon; others only obliquely. The former are in conjunction with the moon; and a line drawn from the centre of the two planets would pass through their zenith. The latter are in quadrature with the moon, that is to say, a line drawn from the terrestrial centre to their zenith, would make an angle of 90 degrees with the line which connects the centres of the two planets. The attracting force acting obliquely is decomposed by the obliquity of its angle of incidence; thus the parts in conjunction being more strongly attracted than those in quadrature, the weight of their particles is diminished. It is necessary then, to there being an equilibrium in all parts of the sea, that the waters should rise under the moon, in order that the excess of weight of the particles in quadrature, above those in conjunction, may be compensated by the greater height of the latter.

The waters, however, rise, not only on the side where the attracting planet is, but, also, on the opposite side; because, if the planet attracts the superior waters more than it attracts the centre of the earth, it also attracts this centre more than it attracts the inferior waters in the opposite hemisphere. These waters will then approach less toward the attracting planet, than the centre of the earth approaches to it. They will remain as far off, from and behind the centre, as the superior waters advance from it on the side of the moon.

Two promontories, or eminences of water, will therefore be formed by the action of the moon upon the earth:—one on the side toward the moon, the other on the side opposite to it, which gives the sea an appearance of an elongated spheroid, whose great axis will pass through the centre of the moon and of the earth. It is *high tide* under the moon and in the opposite point at 180 degrees of distance; consequently, in the two intermediate points, or at 90 degrees of distance from the moon, the tide will be *low*.

The Earth, by its rotatory motion, successively presents to the moon, in the space of 24 hours, all its meridians, which, consequently, are found by turns, and at an interval of six hours, sometimes under the moon, and sometimes at a distance of 90 degrees from it: hence it follows that, during the time which passes between the departure of the moon from one meridian, and its return to the same meridian, that is in the space of a lunar day, which exceeds the solar day by about $50\frac{1}{2}$ minutes, the waters of the sea will ebb twice, and flow twice, in every part of the Earth, although in a manner almost insensible in those places which are distant from the path or orbit of the moon.

The Earth, in revolving upon its axis, carries along with it, to the eastward of the moon, the promontories, or the most elevated portions of water; these, therefore, will still continue to rise by the action of the moon; and, although that action, already less direct, is diminishing in force every moment, yet it subsists, and continues to combat with the inertia and friction which retard the elevation. It is from this reason that the elevation does not attain its *maximum* at the very moment of the moon's passing the meridian, but about three hours after.

A second cause tends to produce the same effect. The waters placed in quadrature, on the west of the moon, and carried toward conjunction with that planet, by the rotatory motion of the earth, will be continually accelerated during the quarter of the day when they are in this position, and will move after the syzgies, or conjunction, with the sum of these

these accelerations, and then meeting with particles continually more retarded than the earth, they will form two contrary currents, which will place the greatest elevation at about 45 degrees past the syzgies. From the like reason the greatest depression of the water will not happen at the quadrature, but three hours after, and at 45 degrees from that point.

Action of the Sun.—If we now imagine the sun to be in the plane of the equator, it is evident that, as its action is similar to that of the moon, it should excite in the ocean an agitation similar to the lunar tides. Thus the sea would ebb twice and flow twice during a solar day; but, on account of the immense distance from the sun, these solar tides will be much smaller than those which result from the action of the moon. According to *Lalande*, the influence of the moon is $2\frac{7}{10}$ times greater than that of the sun. *Laplace* considers it even triple.

On account of the inequality which exists between the solar and lunar days, the action of the sun will sometimes change the position of the lunar tides, and at other times will unite its influence with that of the moon. In the syzgies, or conjunctions, the action of the moon concurs with that of the sun to raise the waters. This is the reason why the highest tides happen at new and full moon; or when the moon is in its first or third quarters. In the quadratures, the waters of the sea are depressed by the action of the sun, at the same point where the action of the moon raises them, and reciprocally. Thus the tides of the quadratures ought to be less. But the highest tide does not, and should not, happen precisely on the day of the new and full moon, but two or three days after. The reason of this is, that the motion once acquired is not all at once destroyed; it continues to augment the elevation of the waters, although the instantaneous action of the sun is, in reality, diminished.

What we have already explained regards the position of the sun and moon in the equator. Let us now consider these heavenly bodies in their various declinations, and we shall see the elevation vary in the inverse ratio of the cube of the distance of the water.

Without entering into details, which would require mathematical demonstrations, we shall remark only that, the proximity of the sun and moon seems to be the cause to which we must refer the extraordinary equinoctial tides, which happen most frequently; the one before the *vernal equinox*, and the other after the *autumnal*; that is, both of them at the time when the sun, passing through the meridional signs, is nearest us. But this does not happen every year, because there are sometimes variations produced by the situation of the orbit of the moon, and by the distance of the syzgies from the equinoxes. The great inequalities of the depth of the sea, the situation of the coasts, their declivity under water, sometimes rapid, sometimes otherwise; the different breadth of the channels and straits; and, lastly, the winds and currents; all these local, and sometimes accidental, circumstances alter the progress of the tides;—make them deviate from that regularity which they would have maintained in an open sea;—augment the impetus of the flow upon the coasts of confined channels;—and, by causing the degree of friction to which the waters are exposed to vary, shorten or prolong the relative duration of high and low water. Thus we see in the islands of the Pacific Ocean regular tides of only one or two feet elevation, whilst upon the western coasts of Europe, and upon the eastern coasts of Asia, the tides are extremely strong, and subject to many variations.

If it be objected to this theory of lunar attraction that there are gulfs as well as inland seas in which there are no tides, we may answer that these phenomena are additional proofs in favour of the hypothesis against which they are brought. In small collections of water the moon acts at the same time upon every part; it diminishes the gravity of the whole mass. But there is little or no surrounding water which can come and accumulate with the body thus attracted and elevated; for this swelling owes its origin less to a vertical or perpendicular motion of the attracting waters than to the lateral flowing in of the neighbouring waters, in consequence of their superior gravity. This is the reason why the Mediterranean has very small tides only."

In the Journal of the Royal Geographic Society, 1833, is a paper entitled "*On the Seiches of Lakes*," by Colonel J. R. Jackson. The phenomenon known by the name of *Seiches* consists in an occasional rise and fall of water, in a lake or inland sea. It has often been observed in the Lake of Geneva and other lakes of the continent, and likewise in the Baltic Sea. The rise of water occurs without wind or any other apparent cause; and while the phenomenon lasts the waters rise and fall several times in the course of a few hours. The oscillations, more or less considerable, sometimes attain the height of five feet, although the general maximum seldom exceeds two, and in the greater number of cases the rise is limited

limited to a few inches. The Seiches happen indifferently in all seasons and all hours of the day; but are most frequent in the spring and autumn.

The effect seems to be produced, chiefly, by the unequal pressures of the atmosphere; particularly when it has been loaded with heavy clouds, or when the weather, in other respects serene, has threatened to be stormy, and the barometer has sunk. The Seiches rise highest in summer, and especially in the close of that season.

Should it hereafter prove that the effect described is produced by unequal atmospheric pressure,—the question naturally follows,—How may this inequality of pressure locally affect the rise of tide, the currents, *rollers*, and other inequalities of the ocean?—See the *Journal*, vol. iii. p. 271.

It is a well-known fact, that on all coasts where tides prevail, the stream of flood continues to run, in the offing, some time after it is high water on the shore; and the stream of ebb, in like manner, after low water on shore.

The length of time between the changes of the tide on the shore and the stream in the offing, is in proportion to the strength of the current and the distance from the land; that is, the stronger the current, and the greater distance that current is from the land, the longer it will run after the change on the shore.

The discussions and experiments on the tides, by Messrs. Lubbock and Whewell, which have recently excited the attention of the scientific, are particularly noticed, in conjunction with his own observations, by Capt. Fitz-roy, in his *Appendix*, pages 277—297.

Captain F. has observed that, where the sea rises the barometer commonly falls, and he thinks that the phenomenon of the ocean, commonly called the ‘*Rollers*,’ may be caused by a diminished pressure of the atmosphere at some places, while at other more distant parts there is an increased pressure. See ‘*Colombian Navigator*,’ vol. iii. note page 27.

TIDE-TABLE.

THE following Table, which exhibits the Times of High Water, with the mean Vertical Rise of Spring-Tides on the different Coasts of the Atlantic, will show, more clearly than any other argument, the nature of the Tides on the Ocean. A few explanatory remarks, which may be found practically useful, are annexed to each division.

	TIME. RISE.			REMARKS.
	h.	m.	Feet.	
BRITISH COASTS.				<p>RIVER THAMES.—During strong north-westerly gales the tide marks high water earlier in the River Thames than otherwise, and does not give so much water, whilst the ebb-tide runs out later, and marks lower; but upon the gale's abating and the weather moderating, the tides put in and rise much higher, whilst they also run longer before high water is marked, and with more velocity of current, nor do they run out so long or so low.</p> <p>The time which the flood-stream runs in the middle of the English Channel, after the time of high water on shore, is, westward of the meridian of Portland, about three hours; but, to the eastward, off Beachy Head, only one hour and three-quarters. In the offing, between the meridians of Dungeness and Folkestone, the North Sea and Channel-tides seem to meet; and the ebb of the one, uniting with the flood of the other, set in an easterly direc-</p>
London Docks.....	2	10	.. 18	
Woolwich.....	2	5	.. 17	
Nore.....	12	30	.. 14	
Margate Roads.....	11	40	.. 16	
North Foreland.....	11	15	.. 17	
Ramsgate.....	11	20	.. 21	
Deal.....	11	15	.. 18	
Dover.....	11	15	.. 17	
Folkestone.....	10	45	.. 20	
Dungeness, on the West.....	10	30	.. 24	
Beachy Head.....	10	16	.. 18	
The Park and Selsea.....	11	0	.. 15	
Portsmouth Harbour.....	11	40	.. 16	
Southampton.....	11	35	.. 13	
Cowes.....	11	15	.. 15	
Needles.....	8	56	.. 9	
Weymouth and Portland Road.....	6	40	.. 7	
Lyme Regis.....	6	30	.. 13	
Exmouth Bar.....	6	25	.. 13	
Torbay.....	6	0	.. 16	
Dartmouth.....	6	5	.. 19	
Plymouth Sound, Hamoaze, &c.....	6	5	.. 16	
Devonport.....	5	20	.. 20	

	TIME.	RISE.	REMARKS.
	h. m.	Feet.	
BRITISH COASTS, continued.			
Fowey	5 30	.. 16	tion, off the French coast, more than four hours after high water on the western shore of Dungeness. But, for the particulars of this, and of the various inflections, &c. of the tide in the Channel, see the Book of Sailing Directions, in which they are minutely described.
Falmouth	5 15	.. 18	
Lizard Point	4 55	.. 18	
Mounts Bay	4 40	.. 20	
Longships, &c.	4 30	.. 20	
St. Mary's, Scilly	4 30	.. 18	
St. Ives, Cornwall	4 30	.. 22	
Padstow	5 0	.. 24	
Lundy Island	5 15	.. 17	
Minehead	6 0	.. 36	
Kingroad, near Bristol	6 45	.. 46	During the flood, the stream off the LAND'S END, where it divides, sets from the southward to the northward nearly 9 hours; and, within Scilly, it generally continues so to run about 8 hours. The ebb, therefore, here runs to the southward only 3 or 4 hours; a circumstance which should be particularly attended to.
(In Nov. 1813, by actual measurement, the tide rose 50 ft.)			
St. Gowen's Head	5 50	.. 24	
St. Anne's Point	5 44	.. 21	
Pembroke Dock-yard	5 48	.. 22½	
Haverfordwest	6 30	.. 12	
IRELAND.			
Port Rush	5 50	7 to 8	On every part of the EASTERN COAST OF IRELAND, in the vicinity of <i>Drogheda</i> , or between Clogher Head and Lambay Isle, it is high water nearly at the same time, 10 h. 30 m. The flood-tide comes along this coast from the southward, following the curvatures of the bays: in-shore it runs briskly, but does not extend far out to the offing. When it arrives abreast of Dundrum, it meets with the stream coming from the north of Ireland, and more or less, near St. John's Point. In consequence of this meeting of the tides, the water rises to a great height, in a heavy and turbulent sea: from hence the stream of flood comes North about, and the ebb from the southward. In the offing the stream of tide is scarcely perceptible.
Rachlin Island Bay	8 0	.. 4	
Torr Point	9 40	.. 9	
Belfast	10 5	10 to 12	
Loch Strangford	10 30	14 to 16	
Drogheda Bar	10 40	11 to 13	
Dublin Bar	10 30	.. 12	
Kingstown Harbour	10 17	.. 12	
Wicklow	10 30	7 to 9	
Saltee Islands	5 50	.. 12	
Hook Point, Waterford	5 0	.. 12	
Youghal	5 25	.. 12	
Cork and Kinsale. (In the Harbours)	4 30	.. 15	
Castlehaven, Baltimore, and Cape Clear	4 0	.. 12	
Bantry Bay, Kenmare River, Dingle Bay, and Mouth of the Shannon	3 45	.. 12	
Limerick	6 0	.. 16	
SCOTLAND.			
Fetlar, Shetland	9 30 to 10 0	6½ to 7¾	[A copious description of the various tidal streams about the ORKNEY ISLANDS, and the coast thence to the Estuary of the Thames, is given in our Sailing Directory for the North Sea.]
Balta	9 45	.. 6½	
Lerwick; in the Harbour ..	9 45	.. 10	
Scalloway	9 30	.. 5¾	
Pentland Skerries	8 30	.. 8	
Sinclair's Bay	9 0	.. 9	
Frith of Tain	11 0	.. 12	
Cromarty	11 45	.. 14	
Fort George	12 0	.. 14	
Cowsy Point to Fraserburg ..	11 45	.. 15	
Buchan-ness	12 0	.. 13	
Newburg	12 30	.. 13	
Aberdeen	12 45	.. 14	
Stonehaven and Montrose ..	1 30	.. 13	
Tay Bar	1 45	.. 16	The body of the Flood in PENTLAND FRITH comes from the N.W., and its motion is perceived sooner near the land, on either side, by three hours, than in the middle of the Frith, and
Dundee	2 15	.. 16	

	TIME. RISE.		REMARKS.	
	h. m.	Feet.		
SCOTLAND, continued.				
St. Andrews	2 0	.. 15	is gradually propagated from the shores, outward, as the tide makes. The greatest velocity of spring-tide in the Frith is nine miles an hour; neap-tides do not run three. When spring-tide is at its greatest altitude or depression, the water continues in a quiescent state near half an hour: neap-tides continue so about an hour and a half.	
Fifeness	1 30	.. 14		
Elie, in the Frith	2 11	.. 14		
Leith and Burnt Island	2 15	.. 16		
Hopetown	2 30	.. 17		
COAST of FRANCE, in the CHANNEL.				
Dunkirk to Calais	11 45	.. 19	In the great bight on the West of Cape La Hague, the flood-stream, being directly opposed by the coast, and pent up by the islands of Guernsey, Jersey, &c., accumulates to the height shown in the Table: and it thus forms the stream between Cape La Hague and the Isle of Alderney, called the Race of Alderney, which sets with the velocity of seven miles an hour. The tide hence, round Cape Barfleur, runs with rapidity: and the sea appears violently agitated about that Cape.	
Ambleteuse	11 0	.. 19		
Boulogne	10 40	.. 19		
Etaples	10 35	.. 19		
St. Vallery sur Somme	10 30	.. 19		
Dieppe	10 25	.. 19		
St. Vallery en Caux	10 15	.. 19		
Fecamp	10 0	.. 19		
Le Havre de Grace	9 0	.. 20		
Honfleur	9 30	.. 19		
Caen and Dive	10 0	.. 19		
Isles of St. Marcou	9 15	.. 21½		
Fort La Hogue, &c.	8 0	.. 21		
Cherbourg and Cape La Hague	7 45	.. 21		
Guernsey and Alderney	6 0	.. 35		
Jersey and St. Malo	6 0	.. 45		
Mount St. Michael	6 30	.. 54		
Erqui, the Port of	6 0	.. 40		
Brehat	5 53	.. 37		
Treguier	5 30	.. 32		
Les Sept Isles	5 0	.. 30		
Morlaix and Isle de Bas	5 15	.. 27		
Porsal	5 0	.. 20		
Passage du Four	4 0	.. 19		
Ushant	3 45	.. 21		
The BAY of BISCAY and thence ^o to GIBRALTAR and MALAGA.				
Roads of Bertaume, St. Mathieu, and Conquet	3 0	.. 21	On the Coasts of the Bay, at sea, it flows generally at three hours, and the vertical rise is from 19 to 15 feet, as shown in the Table.	
Bay of Brest	3 30	.. 21		
Brest Harbour	3 45	.. 21		
Road of Dovarnenez	3 15	.. 21		
Bec du Raz	3 12	.. 21		
Port l'Orient	3 30	.. 20		
Blavet or Port Louis	4 0	.. 19		
Mouth of the Loire	3 45	.. 19		
Isle of Oleron, and Entrance of the R. Charente	3 45	.. 19		
Basque Roads	3 40	.. 20		
Rochefort	4 15	.. 21		
Entrance of the Gironde, and Bassin de Arcachon	3 45	.. 16		
Bayonne	3 15	.. 16		
Northern Coast of Spain, from St. Jean de Luz to Cape Finisterre	3 0	.. 16		
All the Ports and Harbours of the same Coast, including Ferrol, Betanzas, &c.	3 45	.. 15		
[For a description of Quiberon Bay, the Road of Basque, Bayonne, and the Coast of Spain, &c., see Section III. hereafter: or, more particularly, the new Book of Directions for the Bay of Biscay, &c., lately published by Mr. Laurie.]				
In the middle of the Strait of Gibraltar, the current mostly and generally sets to the east: but, on each side, the flood-tide sets to the westward. On				

<i>The Bay of Biscay, &c. continued.</i>	TIME.		RISE.	REMARKS.
	h.	m.	Feet.	
On the Coast, between Cape Finisterre and Cape St. Mary, and at the Entrance of the Rivers, generally about	3	0	13	the European side, west of the Isle of Tarifa, it is high water at 11h., but the stream without continues to run until 2 h. On the opposite shore of Africa, it is high water at 10 h., and the stream without continues to run until one o'clock: after which periods it changes on either side, and runs eastward with the general current. Near the shores are many changes, counter-currents, and whirlpools, caused by, and varying with, the winds.
In the Ports and Harbours of the same, generally	3	45	—	
Bay of Arosa	3	45	12	
River Douro; Entrance	2	30	10	
Lisbon	4	0	—	
Setubal	4	30	—	
Lagos, in the River	2	0	13	
Cape St. Vincent and Faro	2	15	—	
On the Coast from Cape St. Mary to the Strait of Gibraltar	2	0	10	
Tavira, Ayamonte, and Lepe . .	1	30	—	
Guelba and Palos	12	40	—	Near Malaga the stream runs along shore about eight hours each way. The flood sets to the westward.
San Lucar	1	45	—	
Bay of Cadiz (Inner part)	1	45	9	
Puntal of Cadiz	2	15	—	
Tarifa Island	12	0	8	
Gibraltar	12	15	—	
Malaga	12	0	3	

COASTS OF AFRICA.

Along the Coast of Marocco, from the Strait of Gibraltar to Cape Cantin	1	30	9 to 10
Suerrah or Mogodor	2	0	10
Cape Geer or Ghir	2	15	10
Cape Boiador or Bojador	12	0	—
Cape Blanco	11	45	6
Bar of the Senegal	10	30	—
Cape Verde	7	45	3
Goeree	7	48	4
Bathurst, at the entrance of the Gambia	8	10	6 to 8
Great Channel of Bissagos . .	9	15	8
East end of Bulama Island . .	4	30	15
Ilhas dos Idolhos, or Isles de Los, (<i>Flood to the N.</i>) . .	6	35	12 to 17
Matacong Island	7	40	11
Scarcies River; Entrance . .	7	10	10
River Sierra Leon	7	50	10 to 12½
Bananas Isles	8	15	8 to 10
Sherbro River	6	0	11
Along the Coast of Guinea, at sea, generally, the vertical rise is about 3½ feet; and in the mouths of rivers, 5, 6, and 7½ feet.			
Cape Coast	3	30	6 to 7
Lagos	4	0	6

The currents on the African coast (hereafter explained,) render the given times of high water uncertain.

Between Cape Cantin and Cape Blanco they are strong, and set as shown on the Chart.

In the road without the Senegal, the current sets chiefly to the S.W. From the bar, strong freshes come down after the rains, and a powerful current of fresh water sets from the river to some distance out to sea.

In the Bay of Yoff, to the N.E. of Cape Verde, the currents set rapidly; and sometimes in dangerous whirls.

At the mouth of the Gambia the greatest rise in the dry season is not more than 6 feet. Here the tide continues to run on the surface for an hour and a half after it ceases flowing on shore.

The level of the sea, in the vicinity of Cape Coast Castle, is higher, by at least six feet, in the rainy season, (which is the season of the strong S.W. and southerly winds, between April and September,) than in the more serene weather of the dry season.

In the rainy season, or S.W. monsoon, trunks of trees are frequently carried on shore, and found at 6 or 8 feet above the level of the sea, of the

	TIME.	RISE.	REMARKS.
	h. m.	Feet.	
<i>COASTS OF AFRICA, continued.</i>			
River Benin; Entrance	4 15	6 to 8	other season; and the tides <i>ebb</i> and <i>flow</i> regularly in the several rivers; but, in the dry season, the same rivers run ebb constantly; the level of the sea being then too low to allow the tide-waters to enter the mouths of the rivers.
Mouth of New Calabar River	5 30	6 to 9	
Entrance of Camaroen River.	6 0	6 to 8	
Corisco Isle	5 0	.. 7	
River Gabon or Gaboon....	6 0	.. 8	
			Some Remarks on the Tides about Cape Blanco, the Channels of the Bissagos, &c., are given in the Description of the Coast, Section III. hereafter.

THE ATLANTIC ISLANDS.

<i>Azores.—Ponta Delgada, St.</i>			
Michael's	2 15	.. 7	These may be considered as a general mean; but the rise and time vary according to the winds, &c.
Angra, Terceira	2 30	.. 6	
Fayal	2 15	.. 4½	On the south side of St. Michael's the tide is regular, and the flood sets to the eastward. In the offing it continues 3 hours later than on shore.
Madeira.—Funchal	12 10	8 to 9	
Canaries, in general. About.	3 0	8 to 10	At the Bermudas the tides vary in different parts of the islands. Common tides rise only four feet.
Cape Verde Isles—St. Nicholas	7 0	.. 6	
Port Praya	6 0	.. 5	
English Road, Bonavista	7 30	.. 5	
Bermudas.—St. George's	7 0 to 8 0	5 or 6	

STRAIT of BELLEISLE, NEWFOUNDLAND, &c.

<i>Coast of Labrador and Strait</i>			
of Belle Isle, generally ..	11 30	.. 7	On all the coasts of Newfoundland the tides are very irregular; being greatly influenced by the prevailing wind.
Red Bay, Labrador.....	7 45	.. 3½	
Bradore Harbour	8 45	.. 4	On all the eastern coast they have nearly the same rising; springs about 6 feet; neaps 4. At the entrance of St. John's they set in a bore.
Little Mecatina	10 30	.. 5	
New and Old Ferolle	11 45	.. —	Between Cape La Hume and Cape Ray the flood sets to the westward in the offing, very irregularly, but generally 2 or 3 hours after high water on shore: See more particularly our <i>Sailing Directory for Newfoundland, &c.</i> , published by Mr. Laurie.
Bays of St. Genevieve and St.			
Barbe	11 30	.. —	
Isle Vertè or Green Island ..	9 0	.. —	
Bay of Pistolet.....	6 45	.. 5	
Croque Harbour	6 30	.. 6½	
Triton Harbour, in Notre			
Dame Bay	6 0	.. 6	
St. John's.....	7 30	5 to 7	
Placentia Harbour	9 15	.. 8	
St. Pierre and Miquelon ..	9 0	6 & 7	
Between Cape Chapeau rouge			
and Cape Ray, generally..	9 0	7 & 8	
Beyond Cape Ray, northward,			
the tide is inconsiderable.			

RIVER of ST. LAWRENCE.

CAPE CHATTE or Chat	12 0	.. 13	From Green Island to Quebec the tides rise irregularly, but very considerably.
River Matane; Entrance....	2 0	.. 12	
Grand Metis.....	2 10	.. 13	From Coudre to Quebec the water falls 4 feet before the tide makes down.
Isle Bic.....	2 15	.. 12	
Green Island	2 45	.. 9½	At the Isle of Coudre, in spring-tides, the ebb runs at the rate of 2 knots.
Brandy Pots.....	3 30	.. —	
Kamouraska Isles	4 0	.. —	The next strongest ebb is between Apple and Basque Isles; the ebb of the River Saguenay uniting here, it
The Traverse	4 30	.. 17	
Isle aux Coudres.....	6 25	.. —	

RIVER of St. LAWRENCE, <i>continued.</i>	TIME. — h. m.	RISE. — Feet.	REMARKS.
Within the Pillars	5 0 ..	—	runs full 7 knots in spring-tides; yet, although the ebb is so strong, the flood is scarcely perceptible; and below the Isle of Bic, there is no appearance of a flood-tide.
Crane Island	5 0 ..	17½	
Orleans Island; East end ..	5 32 ..	—	
QUEBEC	6 37 ..	18	
<i>North Coast of the River.</i>			
Tadousac	2 45 ..	17	On the South side of PRINCE EDWARD ISLE, the tides are regular, but they are very irregular on the North.
Port Neuf.....	2 10 ..	14	
Point Mille Vaches	2 0 ..	—	
Bersiamities Point	11 0 ..	12	
Manicouagan Bay	1 0 ..	12	
St. Nicholas Harbour	12 0 ..	12	
Point Des Monts or Monts Pelées	12 0 ..	12	
At three leagues below <i>Tadousac</i> , or the <i>Saguenay</i> , is the eddy of the flood, and the stream on the surface always sets thence downward. Off <i>Tadousac</i> , the tide ebbs 6h. 15m., and flows 6h. 8m. Both streams here run three quarters of an hour after high and low water. At Green Island, it ebbs 6h. 24m., and flows 6 hours.			
At the Isle aux Coudres, it ebbs 6h. 20m., and flows 6 hours. Here the ebb stream continues an hour and a quarter after low water, and the flood three quarters of an hour after high water. Within the Pillars, off St. Jean, the tide ebbs 6h. 50m., and flows 5h. 25m. Both streams continue to run an hour after high and low water by the shore, but they are influenced in duration by strong winds.			
At the Isle of Orleans, the stream ebbs 7 hours, and flows 5h. 20m. At Quebec, it flows 4h. 45m. only, but runs an hour longer as above.			
<i>GULF of St. LAWRENCE.</i>			
Seven Islands Bay	1 40 ..	9	The tide of the Gut of Canso generally sets in from the southward, but is very irregular, being influenced by the winds. After strong N.W. winds, the water in the Gulf of St. Lawrence is rendered low, which causes the stream to run northward, through the Gut, at the rate of 4 or 5 miles; the contrary happens with southerly winds. [<i>For the Tides and Currents about Sable Island, see the Sailing Directory for Newfoundland, &c., page 107.</i>]
Mingan Island.....	1 30 ..	7	
Eastern Mingans.....	11 30 ..	5	
Kegashka	10 45 ..	5	
Gaspé Bay	1 50 ..	5	
Ristigouche Harbour	3 0 ..	7	
Cocagne to Cape Tormentin, and thence to Pictou Harbour	7 0 ..	6	
Gut of Canso	8 0 ..	8	
Pr. Edward Isle. Charlotte Town	10 30 ..	6	
Magdalen Isles	8 20 ..	3	
<i>BRETON ISLAND, NOVA SCOTIA, &c.</i>			
Jestico or Port Hood	9 0 ..	6	Off Cape Sable the tide runs at the rate of 3, and sometimes 4, miles an hour; and in the Bay of Fundy, the tides are very rapid.
Sidney Harbour	9 0 ..	6	
Louisbourg	7 15 ..	5½	Cape D'Or and Cape Chignecto are high lands, with very steep cliffs, and deep water close under them. The same kind of shore continues to the head of Chignecto Bay, where very
South shore of Madame I. ..	8 0 ..	8	
Ship Harbour in Gut of Canso	8 0 ..	8½	
Chedabucto Bay	8 30 ..	8	
Sable Island. North Side ..	10 30 ..	7	
South Side ..	8 30 ..	8	
Canso Harbour	8 45 ..	7	

	TIME.	RISE.	REMARKS.
BRETON ISLAND, NOVA SCOTIA, &c. <i>continued.</i>	h. m.	Feet.	
Torbay	8 45	.. 8	extensive flats of mud and quicksands are left to dry at low water. Here the tides come in a bore, rushing in with great rapidity: they are known to flow at the equinoxes from 60 to 70 feet perpendicular; and it is remarkable that, at the same time, they rise in the Bay Verte, on the northern side of the isthmus, only 8 feet.
Country Harbour to White Island Bay	9 0	.. 8	
Beaver Harbour	8 45	.. 7	
Spry Harbour	8 30	.. 7½	
Halifax to St. Margaret's Bay	8 0	.. 8	
Mahone Bay to Liverpool Harbour	8 0	.. 8	In the Harbour of St. John, the tide of flood is weak, but the ebb runs very rapidly.
Shelburne Harbour	8 30	.. 8	
Cape Sable	8 0	.. 9	
Cape Fourchu	8 45	.. 13	
Cape St. Mary	9 0	.. 14	
Bay of St. Mary	9 30	.. 16	See farther, with regard to the Tides of the Bay of Fundy, the ' <i>Sailing Directory for Newfoundland, &c.</i> ' pp. 124, 130, 131.
Gut of Annapolis. Entrance	10 0	.. 28	
Cape D'Or. Entrance of Mines Channel	11 0	.. 41	
Basin of Mines, viz.			
Windsor	12 0	.. 36	
Seven Isles Harbour....	11 0	.. 31	At MOUNT DESERT ROCK, the stream of flood divides to run eastward and westward. With the Skuttock Hills about N. N. E., and within 4 or 5 leagues of those of Mount Desert, the flood-stream sets E.N.E. and the ebb W.S.W.; but, at the distance of 9 or 10 leagues from the land, the current, in general, sets to the S. W. and more westward. From the Mount Desert Rock, to the Fox Islands, at the entrance of the Bay of Penobscot, the flood-stream sets W. S. W. along shore; but it, nevertheless, runs up to the northward into Isle Haute Bay, &c.
Cape Split	11 15	.. 40	
Apple River. Chignecto Bay	11 0	.. 32	
Cumberland Basin. Fort....	12 0	.. 60	
Shepody Bay	11 30	.. 48	
St. John's, New Brunswick..	12 0	.. 25	At SANDY HOOK the stream of tide continues to set in, at the rate of two knots, until nearly 9 hours. The tides in the rivers of the CHESAPEAKE are varied by the winds. When it blows 2 or 3 days at N. or N. W., the flood does not rise more than 2 feet; but, when it blows a gale from S.E. or E.S.E., it rises 4 or 5 feet. The times of high-water in the Chesapeake have been given as follow: Lynhaven Bay, or South side, 10 h.: East shore, within Cape Charles, 12 h.: Mouth of the Rappahanock, 3 h.: of the Patomac, 3½ h.: of the Patapsco, or Baltimore River, 7¾ h.
Passamaquoddy; North Bay.	10 45	.. 30	

UNITED STATES.

East Port and Moose Island.	11 30	.. 25	At MOUNT DESERT ROCK, the stream of flood divides to run eastward and westward. With the Skuttock Hills about N. N. E., and within 4 or 5 leagues of those of Mount Desert, the flood-stream sets E.N.E. and the ebb W.S.W.; but, at the distance of 9 or 10 leagues from the land, the current, in general, sets to the S. W. and more westward. From the Mount Desert Rock, to the Fox Islands, at the entrance of the Bay of Penobscot, the flood-stream sets W. S. W. along shore; but it, nevertheless, runs up to the northward into Isle Haute Bay, &c.
Machias	11 0	.. 12	
Mount Desert and Goldsborough	11 0	.. 12	
Penobscot River and Fox Isles	10 45	.. 9	
Townsend, Broad Bay, and George's River.....	40 45	.. 9	
Kennebeck and Sheepscut ..	10 45	.. 9	At SANDY HOOK the stream of tide continues to set in, at the rate of two knots, until nearly 9 hours. The tides in the rivers of the CHESAPEAKE are varied by the winds. When it blows 2 or 3 days at N. or N. W., the flood does not rise more than 2 feet; but, when it blows a gale from S.E. or E.S.E., it rises 4 or 5 feet. The times of high-water in the Chesapeake have been given as follow: Lynhaven Bay, or South side, 10 h.: East shore, within Cape Charles, 12 h.: Mouth of the Rappahanock, 3 h.: of the Patomac, 3½ h.: of the Patapsco, or Baltimore River, 7¾ h.
Portland and Casco Bay....	10 45	.. 9	
Newbury Port and Portsmouth	9 45	.. 10	
Marble-Head, Salem, and Cape Anne	11 30	.. 11	
Boston Lighthouse	11 30	.. 12	
Plymouth, Cape Cod, and Monomoy Point	11 30	.. 6	At SANDY HOOK the stream of tide continues to set in, at the rate of two knots, until nearly 9 hours. The tides in the rivers of the CHESAPEAKE are varied by the winds. When it blows 2 or 3 days at N. or N. W., the flood does not rise more than 2 feet; but, when it blows a gale from S.E. or E.S.E., it rises 4 or 5 feet. The times of high-water in the Chesapeake have been given as follow: Lynhaven Bay, or South side, 10 h.: East shore, within Cape Charles, 12 h.: Mouth of the Rappahanock, 3 h.: of the Patomac, 3½ h.: of the Patapsco, or Baltimore River, 7¾ h.
Race Point	10 45	.. —	
Shoals of George's Bank....	10 30	.. 7	
Nantucket Shoals.....	10 45	.. —	
Nantucket Harbour	12 3	.. 6	
Tarpaulin Cove. Elizabeth Isles	8 52	.. 5	At SANDY HOOK the stream of tide continues to set in, at the rate of two knots, until nearly 9 hours. The tides in the rivers of the CHESAPEAKE are varied by the winds. When it blows 2 or 3 days at N. or N. W., the flood does not rise more than 2 feet; but, when it blows a gale from S.E. or E.S.E., it rises 4 or 5 feet. The times of high-water in the Chesapeake have been given as follow: Lynhaven Bay, or South side, 10 h.: East shore, within Cape Charles, 12 h.: Mouth of the Rappahanock, 3 h.: of the Patomac, 3½ h.: of the Patapsco, or Baltimore River, 7¾ h.
Gay Head; New Bedford, Block Island, and Rhode Island, Harbours.....	7 37	.. 5	
Off Newhaven	9 0	.. 8	
New London, New York, and Elizabeth Town Point....	8 54	.. 6	
Sandy Hook. New York ..	7 30	.. 6	
Cape May	8 45	.. 6	At SANDY HOOK the stream of tide continues to set in, at the rate of two knots, until nearly 9 hours. The tides in the rivers of the CHESAPEAKE are varied by the winds. When it blows 2 or 3 days at N. or N. W., the flood does not rise more than 2 feet; but, when it blows a gale from S.E. or E.S.E., it rises 4 or 5 feet. The times of high-water in the Chesapeake have been given as follow: Lynhaven Bay, or South side, 10 h.: East shore, within Cape Charles, 12 h.: Mouth of the Rappahanock, 3 h.: of the Patomac, 3½ h.: of the Patapsco, or Baltimore River, 7¾ h.
Cape Henry.....	10 0	.. 4½	

	TIME.		RISE.	REMARKS.
UNITED STATES, <i>continued.</i>	h.	m.	Feet.	
Hampton Road	10	30	.. 4	In the vicinity of Charleston and Savannah, N.E., Easterly, and S.E. winds cause higher tides than the other winds, and, also, vary their course. At about 6 leagues from the land, off Port Royal, in 12 fathoms of water, the flood sets strongly to the southward, and the ebb northward. At a great distance from shore no tide is perceptible.
Charleston. South Carolina.	7	15	.. 6	
Port Royal	8	15	.. 6	
St. Simon's Sound	9	0	.. 6	
St. Simon's Bar	7	30	.. 6	
St. Simon's Offing	6	45	.. —	
St. Mary's Bar	8	15	.. 7	
Nassau Bar	7	30	.. 7	
Bar of St. Augustin	7	30	.. 6	
Hillsborough Inlet	7	30	.. 5	
Nassau, New Providence ..	8	20	.. 4	Although, at the BAHAMAS, the rise and fall is inconsiderable, the tide of flood sets an indraught on the northern part of the Little Bahama Bank, from every point of the compass, which renders an approach very dangerous.
South end of Abaco	8	0	.. 3	
Florida Kays. Sombrero Kay	8	0	.. 5	
Dry Tortugas	8	30	.. 3	
Chatham Bay to Cape Roman.				
(Very irregular)	—	—	.. 2	
Mouths of the Missisipi	—	—	.. 1½	

The tide sets with some force directly on and off the western side of the Grand Bank of Bahama; particularly at the full and change of the moon. High water at 7 h. 30 m., or thereabout. Rise 3 to 4 feet. On the Middle Ground of this Bank the tides set in every direction.

In Providence N.W. channel, the current runs, generally, to the eastward, about two miles an hour.

Near Egg Island, to the N.W. of Eleuthera, it is, however, uncertain, and great attention should be paid to the lead. In the passage within Egg Island, the tide runs at the rate of four miles, and rises above four feet; the flood setting eastward, and strongly over the reefs.

About the Berry Islands and Providence, the water rises two feet higher when the sun comes to the northward of the line, than it does when the sun is to the southward, and its strength is in a similar proportion. Here and at the Bemini Isles the flood sets to the N.E.

Near Cayo Hueso, now Kay West, on the Florida Reef, the tides are, in some measure, regular within the reef; the flood setting to the westward, and the ebb contrary. To the westward, between the Tortugas and Cayo Marques, the flood sets variably through to the northward, and ebbs to the E.S.E.

It is remarkable that, on the south side of these Kays, the flood comes from the S.E. ward; but, on the north side of them, all the way from Cayo Hueso the flood runs to the eastward, along the edge of the bank, and to the southward, through the little channels, in order to fill up the intermediate bays and lagoons, with the assistance of the flood from the southward.

Westward of Kay West there is a general current to the S.W. ward, along the reef, and to some distance to the south side of it.

In Ponce or Chatham Bay it runs tide and half-tide; viz. 3 hours flood, then 3 hours ebb: next 9 hours flood, &c. Here, in some places, it is a mere fall; but in some of the channels it is as much as four men can do to stem the current with a boat.

During a S.E. gale or storm, the water in the bays and rivers of West Florida has been known to rise 7 feet perpendicular, and vessels of burthen have been driven in, among the pine-trees, at some distance from shore.

From Cape Roman, northward and westward, the tide seems to ebb and flow only once in the 24 hours; but it is irregular, and much governed by the winds. Yet the effects in a dry season are very perceptible in the rivers at a distance from the sea.

MEXICAN SEA AND WEST INDIES.	TIME.	RISE.	REMARKS.
	h. m.	Feet.	
Vera Cruz (only 1 tide in 24 hours) <i>Irregular</i>	— —	.. 2	Near the Shoals and Reefs of Anton Lizardo, between Alvarado and Vera-Cruz, the currents are often dangerous, and appear to be almost entirely influenced by the winds. The pilots say that a change of wind hereabout produces an alteration in the current within six hours.
Tampico, <i>about</i>	2 30	.. 2	
Cape Antonio, Cuba (<i>Irreg.</i>)	9 30	.. 1½	
Cartagena	2 0	.. 1	
Port Royal, Jamaica (<i>Uncer.</i>)	— —	.. 1	
Miraporvos, near the Crooked Islands	9 30	1½ to 3	
Hayti. Cape Haytien	6 0	.. 2½	
Porto-Rico. St. Juan	8 20	.. 1½	
Nassau, New Providence	6 0	7	
Tortola; Old Road, <i>about</i> ..	10 0	1½ to 2	
St. Bartholomew's .. (<i>Irreg.</i>)	— —	1 to 1½	Among the West Indian Islands the tides are, generally, so inconsiderable, as scarcely to require notice, but the direction is variable, and the strength so great as to demand precaution. On the continental coast the stream of tide, within a certain distance from shore, blends more or less with the currents.
Guadeloupe and Martinique (<i>Irregular</i>)	6 45	.. 1½	
St. Lucia	(<i>Irregular</i>) — —	.. 1½	
Barbadoes; in the Careenage	— —	1 to 2	
Tobago	3 0	.. 3½	
Trinidad; Boca de Navios ..	3 30	.. —	
Boca de Monos	3 50	.. —	
Port Spain	4 30	.. 6	
Pta. de Gallo (near the S.W. Point)	4 0	.. —	
Demerary. Entr. of River ..	4 30	.. 9	
Berbice	— —	11 or 12	
Surinam. Bram's Point	4 30	.. 7	
Isles du Salut	4 10	.. 9	
Cayenne	3 45	.. 6	

About the Island of St. Bartholomew, the flood, at new and full moon, runs S.E., and it is then high water at 10 h. 30 m. *p.m.*, while the sun is farthest to the north of the Equator; but comes about two hours sooner in the following months, till the sun gets farthest to the south, when it is high water at 10 h. 30 m. *a.m.*; and it runs afterward in the same proportion back again. The winds, which are of long continuance, sometimes make a trifling difference. The horizon is also lowest at the time when the sun is farthest to the north of the line; and so to the contrary. The greatest difference in the ebbing and flowing is 18 inches; but, in general, only 10 inches.

About Virgin-gorda and the passages of the Virgin Islands, the current runs regularly, setting eastward during the moon's passage from the horizon to her zenith, and from her setting till she arrives at nadir, and to the westward while the moon passes from zenith to the horizon, and from nadir till her rising. The rate varies according to the breadth of the channels, from 2 to 5½ knots, and the rise is from 20 to 40 inches.

"At *Tortola Old Road*, Mr. Lewis, a respectable merchant, has stated the mean rise to be 18 inches; but, during fresh northerly winds, two feet; and that the results were derived from two years of careful observations: his residence being situated at the water's edge.

"Similar particulars are of greater importance in seas where the tides run more strongly than they do among the Caribbees: yet, even here, in the event of a ship's *grounding*, a knowledge of the time and quantity of rise, be the latter however small, may prove of essential service. In assisting, with the boats of a transport, to get the *Gilbert Monro*, West Indiaman, afloat at Barbadoes, the time of high water was adverted to, and most opportunely a naval officer, who had observed the flow of that afternoon, was enabled to give the desired information, and an effort made at the corresponding hour of the night was successful."—*Lieut. W. H. Brady.*

III.—OF THE CURRENTS.

A CURRENT is at present to be understood as that *atmospherical* motion of the water, which has been already noticed. In other words, as a stream on, or a particular set in the

direction of, the surface of the sea, occasioned by winds and other impulses, exclusive of (but which *may be influenced by*) the causes of the tides. It is an observation of *Dampier*, that CURRENTS are scarcely ever felt but at sea, and TIDES but upon the coasts: and it is certainly an established fact that *Currents* prevail mostly in those parts where the tides are weak and scarcely perceptible; or, where the sea, apparently little influenced by the causes of the tides, is disposed to a quiescent state. This will be obvious by an attentive consideration of the following descriptions. The necessity of attention to the silent, imperceptible, and therefore dangerous, operation of currents, will be equally apparent.*

OF THESE CURRENTS there are two distinctions:—1. The *Drift-Current*: 2. The *Stream-Current*.

The DRIFT or DRIFT-CURRENT is the mere effect of a *constant* or *very prevalent* wind on the surface-water; impelling it to leeward until it meets with some obstacle which stops it, and occasions an accumulation and consequent *stream* of current. It matters not whether the obstacle be *land*, or *banks*, or a *stream of current* already formed. The Drift-current is generally shallow, and at a mean, perhaps, of no more than half a mile an hour, when the wind is constant and a good breeze. Such a current, from a predominance of westerly winds, occupies the northern region of the Atlantic, from the N.W. and West to the E.N.E. and S.E.; and such, likewise, is the central portion of the Ocean under the influence of the Trade-wind.

The STREAM-CURRENT is formed by the accumulated waters of a *Drift-current*. It is more limited, but it may be of any bulk, or depth, or velocity. Of such is the temporary stream, setting at times from the Bay of Biscay to the west of Ireland; and of such is the *Florida* or *Gulf-Stream*, setting from the Mexican Sea to the Banks of Newfoundland, and terminating to the west of the Azores.

In some parts the current is compounded of *drift* and *stream*; for a *stream*, already formed, may pass through the region of a prevalent wind, in a direction according with that of its *drift* current, and receive an acceleration of motion from it accordingly. Of such is the Equatorial current, which will be presently noticed.

Of the currents of the Atlantic, the first in order, from the Land's End of England, is RENNELL'S CURRENT, a temporary but extensive stream, which sets at times from the Bay of Biscay to the westward and N.W., athwart the entrance of the English Channel, and to the westward of Cape Clear.

Second.—The ARCTIC or GREENLAND CURRENT; with EASTERLY and S.E. DRIFT CURRENTS to the Coasts of Europe and Africa, and Southerly to the Coast of Guinea.

Third.—The AFRICAN or GUINEA CURRENT, an easterly stream along the coast of Africa, into the Bights of Benin and Biafra, with a westerly outset from the same.

Fourth.—The CENTRAL or DRIFT CURRENT, between the Azores and Bermudas, &c., generally to the W.S.W.

Fifth.—The EQUATORIAL CURRENT, a vast stream passing over the Equator from the E.S.E.; thence dividing into two great branches, of which the western forms the main stream; the eastern partaking more of a drift, and proceeding to its highest northern parallel, when the N.E. trade fails most remotely from the Line. The western branch runs to the W.N.W. and N.W. to the Caribbean Sea; the eastern more to the North; and, *at times*, even N.N.E. and N.E. to the Cape Verde Islands.

Sixth.—The CURRENTS of the COLOMBIAN or CARIBBEAN SEA, and the MEXICAN STREAM, an inset into the Mexican Sea, from the south-eastward.

Seventh.—The FLORIDA or GULF STREAM, an outset from the Mexican Sea, setting thence to the north-eastward, through the Strait of Florida, and thence eastward toward the Newfoundland Bank and Azores.

Eighth.—The STREAMS of NEWFOUNDLAND and ST. LAWRENCE, setting from the North and N.E., and from the River and Gulf of St. Lawrence around Breton Island, to the southward, and south-west.

* The streams of tide probably extend much farther from land than is generally supposed: at least it has appeared so from numerous sidereal and chronometric observations which I could by no other means reconcile than by supposing the vessel to be affected by tides.—*A. L.*

This remark seems to have been corroborated by the Baron Roussin, on the coast of Western Africa.—*Ed.*

In explaining this subject, we shall endeavour, in the first place, to establish the facts which prove the existence of these currents, and then attempt to deduce the causes, according to the given descriptions.

1. OF RENNELL'S CURRENT; OR THE CURRENT ATHWART THE ENTRANCE OF THE ENGLISH CHANNEL.

This current, which is occasionally of considerable breadth and strength, frequently sets athwart the entrance of the Channel to the N.W. and W.N.W. at some distance to the westward of the isles of Ushant and Scilly. As it apparently depends on temporary circumstances, it is considered as a temporary stream; and, although a certain quantity of northerly indraught is always to be allowed for, with the tide of flood, on approaching the Scilly Islands, the current, unless with particular winds on the ocean, will be scarcely, if at all, perceptible.

The general causes of currents, so far as they depend upon the set of the winds, &c., are generally known to seamen; and, that, a long continued wind, in one particular direction, will either produce a stream, where no obstruction exists, or cause an accumulation of the water against an opposing coast, until a reverberation takes place, needs no demonstration. The latter appears to be the case in the present instance. A long and continual prevalence of westerly and south-westerly winds, in combination with a current, that commonly sets into the southern part of the Bay of Biscay, occasions an accumulation of water in the Bay, which seeks an escape, by setting to the N.W. or W.N.W. within the limits described by the half-arrows in the accompanying Chart.

That such a current does actually prevail, is too well known to be longer doubted. Mr. KELLY, the author of a Treatise on Navigation, published near a century ago, has given a particular instance of it: by which he shows that a ship becalmed, with her sails furled for 48 hours, was in that time carried by the current 46 miles to the northward,* and we have many subsequent examples of vessels which have been set, by the course of the stream, to the northward, or upon the rocks, of Scilly. But the writer to whom we are more particularly indebted for an elucidation of the subject, is the late MAJOR RENNELL,† who has given

* Had observations for the longitude been made, it is probable that the current would have been found, also, to have set westward. See, further, hereafter.

† From the name of this gentleman, the current is now generally denominated RENNELL'S CURRENT.

The Currents of the Ocean appear to have attracted the attention of Major Rennell at an early period, and they continued to occupy that attention until the last ebb of his honorable life. The results have appeared before the world in five large charts, with a descriptive volume, dedicated to his late Majesty, William the Fourth.

The Major's first chart and Remarks on the Agulhas or South-African Current appeared in the year 1778, and the important tract on the Scilly or 'thwart Channel Current, in the year 1793. In the mean time, and subsequently, some cursory remarks on the same subject were introduced in the Illustration of the Geography of Herodotus, the Philosophical Journals, &c. In or about the year 1810, on the suggestion of a friend, who expressed a wish to see all his writings on this subject combined and re-published, he commenced his *Current-Charts of the Atlantic Ocean*, and collected from the Journals of his numerous friends a gleaming of information which, at length, from repeated accumulations, presented a most beautiful and singular instance of successful perseverance, on a subject never before attempted, upon a plan so comprehensive. To an ordinary mind such a topic would have been regarded as dull, uninviting, and impracticable; by the author it was appreciated according to its importance and usefulness to mankind, and he treated it accordingly. He had long lamented the general ignorance prevalent on this subject, and which had, from time to time, produced so much loss of life and treasure, especially in relation to his native country. It is true that, in latter times, practice and experience have taught the mariner, in many cases, how to shape his course to the best advantage; but still he was deficient in *theory*, and knew not the *rationale*, the *why and wherefore*, of the courses which he adopted, and the variations which might be most advantageously made in his outward or homeward passages, according to the fluctuations of season and circumstances. Such knowledge is now, in a great measure, supplied.

Among the names of the contributors to the work on the Currents, that of Captain Edw. Sabine is conspicuous: and, were any apology required for the undertaking, his words might be quoted with propriety. In the year 1825, this gentleman published his "*Account of Experiments to determine the figure of the Earth, by means of a pendulum vibrating seconds in different Latitudes, as well as on various subjects of Philosophical Enquiry*;" and in that volume he has given his testimonial of the necessity of the 'Investigation' in the following terms.

"On a general review of the Currents particularized on the Pheasant's progress (in 1822) in her voyage, commencing at Sierra Leon and terminating at New York, it was found that she was indebted

given an illustration of it, which places it beyond all controversy; and from whose paper, published in the *Philosophical Transactions* of the year 1793, we abstract the following observations:

"In crossing the eastern part of the Atlantic, the *Hector*, East-India ship, Captain Williams, in 1778, encountered between the parallels of 42 and 49, very strong westerly gales; but particularly between the 16th and 24th of January; when, at intervals, it blew with uncommon violence. It varied two or more points, both to the north and south-west, but blew longest from the northern point; and extended, as subsequently appeared, from the coast of Nova Scotia to that of Spain.

"Within sixty or seventy leagues of the meridian of Scilly, on the 30th of January, between the parallels of 49 and 50, the effect of the current was first experienced, which set the ship to the north of her intended parallel, by nearly half a degree, in the interval between two observations of latitude; namely, in two days. The wind, ever afterward, prevented the ship from regaining the parallel; for although the northern set was trifling, from the 31st until she arrived near Scilly, yet the wind being scant and light, never enabled her to overcome the tendency of the current. It is also to be observed, that the direction of the current was much more westerly than northerly; the ship crossed it on so very oblique a course as to be in it a long time, and was driven, as it appears, nearly 30 leagues to the west by it: having soundings in 73 fathoms, in the latitude of Scilly, and afterward ran 150 miles by the log, directly east, before she reached the length of the islands; running, in effect, 120 miles, and shallowed the water only nine fathoms.

"The current was not only sensible by the observations of latitude, but by rippings on the surface of the water, and by the direction of the lead line. In consequence of all, the ship was driven to the north of Scilly, and barely able to lay a course through the passage between those islands and the Land's End.

"There being no time-keeper on board, the longitude was uncertain; but it was concluded that the current, at times, extends to 60 leagues west of Scilly, and runs close to the west of the islands. The breadth of the stream, where the *Hector* crossed over it, was supposed to be about 30 leagues.

"A journal of the *Atlas*, East India ship, Captain Cooper, furnishes much clearer proofs, both of the existence of the current, and the rate of its motion. This ship, outward bound, in January, 1787, had advanced 55 leagues to the westward of Ushant, when violent gales began at south, and for four days continued between that point and W. by S.; during which time the ship was lying-to, with her head to N.W. On the fifth day the wind abated, but was S.W.; stormy weather then ensued for nine days; the wind blowing from all points between South and S.S.W., but chiefly, and most violently, from W.S.W. and S.W.; and, when the ship then proceeded southward on her voyage, she was, by the reckoning, only $2\frac{1}{4}$ degrees of longitude west of Cape Finisterre; but, by time-keepers, more than *four degrees and a half*.

"On the day the gales commenced, the reckoning was within 14 minutes of that by the time-keepers; the latter being more westerly, owing to the current. On the third day after, the difference was but 24 minutes, when the ship was 25 leagues S.W. from Scilly, in soundings of 70 fathoms. The ship, in longitude $8^{\circ} 28'$, had entered into the stream; and, its course being opposite to that of the *Hector*, it facilitated her progress, and carried her clear of the S.W. coast of Ireland.

"After this in the course of 51 hours, the ship had set two whole degrees to the westward of her reckoning; and, in the 45 hours following, she had a farther set of 23 minutes; so that, in four days only, she had been carried by the current no less than two degrees and 23 minutes; and, since the gale began, $2^{\circ} 32'$ of longitude, or 93 nautic miles.

"It consequently appears, that the *Atlas* experienced a westerly current, from about 24 leagues W.S.W. of Scilly, to near four degrees of longitude west of the meridian of Cape Clear, where its effect was imperceptible. It may, therefore, be inferred, that the stream

debted to their aid, on the balance of the whole account, and in the direction of her course from port to port, not less than *sixteen hundred geographic miles*, the whole distance being nine thousand; affording a very striking exemplification of the importance of a correct knowledge of the Currents of the Ocean to persons engaged in its navigation; and consequently of the value of the information in the acquisition and arrangement of which Major Rennell has passed the latter years of his most useful life."

goes off to the N.W. in the parallel of 51° ; between longitude 14° and 15° , and the S.W. coast of Ireland.*

"No northern set is indicated in the journal of the *Atlas*. This would have been remarkable, had the weather permitted nice attention to the reckoning; but, it is to be remarked that, observations on the latitude were not regularly made; and besides, that the great distance of 36 miles was allowed for only 20 hours' drift to the N.W., when the ship was lying-to.

"From the nature of this current it must be obvious, that its velocity will always be proportionate with the strength and direction of the wind, by which its direction will also be regulated, and that the middle of the stream will preserve its original course in a greater degree than its borders. The direction of this appears to be N.W. by W.; the eastern border more north; and the western more west: so that the northern current is stronger close to the west of Scilly than more to the westward.

"From the foregoing observations may be deduced the following inferences:—

"1st. That ships, which cross the current obliquely, steering a true E. by S. course, or more southerly, will continue longer in it, and be more affected by it, than those which steer more directly across it. In crossing it with light winds, the effect will be the same. Allowance should also be made for the more northerly direction of the eastern edge of the current.

"2d. That, after a continuance of westerly gales, even should a good observation of latitude be made, it would be imprudent to run eastward, from the Atlantic, during a long night. For a ship might remain in the current so long as to be drifted from a parallel, deemed a very safe one, to that of the rocks of Scilly. It is therefore recommended, that vessels, at such times, should keep, at the highest, in $48^{\circ} 45'$, because in $49^{\circ} 30'$ the whole effect of the current may be experienced in the worst situation. But, from the current in $48^{\circ} 45'$, a southerly wind will set the ship into the channel. In time of peace, coming from the Atlantic, it would be still better to make Ushant.

"3d. That ships, bound to the westward, from the channel, with a south-westerly wind, so that it may appear indifferent which tack they go on, should prefer the *larboard* tack, as they will then have the benefit of the current."

In a SUPPLEMENTARY PAPER on the EFFECTS of WESTERLY WINDS in RAISING the LEVEL of the ENGLISH CHANNEL, dated 22d of June, 1809, Major Rennell has stated,

"In the '*Observations on a Current that often prevails to the Westward of Scilly,*' which I had the honour to lay before the Royal Society many years ago, I slightly mentioned, as connected with the same subject, the effects of strong westerly winds, in *raising* the level of the British Channel; and the escape of the superincumbent waters, through the Strait of Dover, into the *then* lower level of the North Sea.

"The recent loss of the *Britannia*, East India ship, Captain Birch, on the Goodwin Sands, has impressed this fact more strongly on my mind; as I have no doubt that her loss was occasioned by a current, produced by the running off of the accumulated waters; a violent gale from the westward then prevailing. The circumstances under which she was lost, were generally these:—

"In January last she sailed from her anchorage between Dover and the South Foreland, (on her way to Portsmouth,) and was soon after assailed by a violent gale between the west and south-west. The thick weather preventing a view of the *lights*, the pilot was left entirely to the reckoning and the lead; and, when it was concluded that the ship was quite clear of the Goodwin, she struck on the north-eastern extremity of the southernmost of those sands. And this difference between the reckoning (after due allowance being made

* Captain J. W. Monteath, in the ship *Fame*, Sept. 1817, in lat. 51° , long. 20° to 13° , experienced a current (which he allowed for and found correct) setting from W.N.W. to N.W., at the rate of from half to three-quarters of a mile an hour. The first part of this course, it may be observed, was on the parallel traversed by the *Atlas*, and commenced more than four degrees to the westward of the true course of that ship.

Add to this, that, after a long prevalence of westerly winds across the Atlantic, and in running for Cape Clear, from lat. 50° , and long. 17° , when nearly on the parallel of the Cape, Capt. Chas. Hare, in the ship *Waterloo*, 11th Sept. 1821, found, by chronometer, &c., that a current had set the ship 54 miles W. by N. in the 24 hours, preceding the noon of that day.—EDITOR.

for the tides) and the actual position, I conclude was owing to the northerly stream of current, which caught the ship, when she *drifted* to the *back*, or *eastern side*, of the Goodwin.

"The fact of the high level of the Channel, during strong winds, between the West and S.W., cannot be doubted; because the increased height of the tides in the southern ports, at such times, is obvious to every discerning eye. Indeed, the form of the upper part of the Channel, in particular, is such as to receive and retain, for a time, the principal part of the water forced in, as may be seen by the Chart; and, as a part of this water is continually escaping by the Strait of Dover, it will produce a current, which must greatly disturb the reckonings of such ships as navigate the Strait, when thick weather prevents the land, or the lights of the Forelands and the North Goodwin, from being seen.

"I observe, in a new publication of Messrs. Laurie and Whittle, entitled '*Sailing Directions, &c. of the English Channel*,' that, throughout the Channel, it is admitted by the experienced persons whom they quote, that strong S.W. winds 'cause the flood-tide to run an hour, or more, longer than at common times:' or, in other words, that a *current overcomes the ebb-tide a full hour*; not to mention how much it may accelerate the one, and retard the other, during the remainder of the time.*

"It is evident, that, the direction of the current under consideration will be influenced by the form and position of the opposite shores, at the entrance of the Strait; and, as these are materially different, so must the direction of the stream be within the influence of each side, respectively. For instance, on the English side, the current having taken the direction of the shore between *Dungeness* and the *South Foreland*, will *set* generally to the north-east, through *that* side of the Strait. (See the Chart.) But, on the French side, circumstances must be very different; for the shore of *Boulogne*, trending almost due north, will give the current a like direction, since it cannot turn sharp round the point of *Grisnez*, to the north-eastward; but must preserve a great proportion of its northerly course, until it mixes with the waters of the North Sea. And it may be remarked that, the *Britannia*, when driven to the eastward of the Goodwin, would fall into this very line of current.

"There is another circumstance to be taken into the account, which is, that the *shore of Boulogne*, presenting a direct obstacle to the water impelled by the westerly winds, will occasion a higher level of the sea there than elsewhere; and, of course, a stronger line of the current toward the Goodwin. (See the Chart.)

"It must, therefore, be inferred, that, a ship passing the Strait of Dover, at the back of the Goodwin Sands, during the prevalence of strong West or S.W. winds, will be carried many miles to the northward of her reckoning; and, if compelled to depend on it, may be subject to great hazard, from the Goodwin.

"It will be understood, of course, that, although the stream of current, alone, has been considered here, (in order to simplify the subject,) yet that, in the application of these remarks, the regular tides must also be taken into the account. But, from my ignorance of their detail, I can say no more than that I conceive that the great body of the tide from the Channel must be subject to much the same laws as the current itself. The opposite tide will doubtless occasion various inflections of the current, as it blends itself with it; or may absolutely suspend it: and the subject can never be perfectly understood, without a particular attention to the velocity and direction of the tides in moderate weather, to serve as a ground-work."†

FURTHER OBSERVATIONS ON RENNELL'S CURRENT.

After the publication of the first paper on the current of the Channel, and the supplementary paper immediately preceding, Major Rennell published some further important observations upon it, which were read before the Royal Society, April 13, 1815, and from which we have the following extracts:—

"During the interval of twenty-one years, since the Society did me the honour to receive my Observations on the Current to the Westward of Scilly, more facts, relating to that

* It is also asserted, that, in the mouth of the Channel, the extraordinary rise of tide, in stormy weather, is ten feet: that is, in common springs twenty, and in storms thirty, feet.

† Messrs. Laurie and Whittle's publication allows the tides in this quarter a velocity of one mile and a half per hour, at the springs; half a mile at the neaps. The *Britannia's* accident happened at *dead neaps*.

current, have been collected, as well as observations on its effects, in different parts of its course, between Cape Finisterre and Scilly; the whole tending to a confirmation of the general system set forth, in 1793; and, in one instance, affording, perhaps, a clearer proof of the strength of the stream, in respect of its *northerly* direction, than any of those adduced on the former occasion.

"In pursuing the detail of these facts and observations, I shall begin in the neighbourhood of Cape Finisterre, and proceed with the course of the current, along the Bay of Biscay; and thence across the mouth of the English Channel, to Scilly, and the entrance of St. George's Channel.

"The first three facts regard the current from the open sea, setting into the south side of the Bay of Biscay, and along the north coast of Spain; which current has been supposed, in the former paper, to be occasioned by the prevalent westerly winds, which force the water near the shore, *into the Bay*, and along the southern coast of it. The water so displaced, would be followed, of course, by the adjacent water *behind* it, in the open sea; and so on, successively, to a certain extent. This cause must surely be referred to, as the origin of the Scilly current.

"I. The first case is that of the *Earl Cornwallis*, East India ship. The circumstance occurred on her outward passage; she was well provided with time-keepers, as most of the India ships are.

"On the 12th of March, 1791, between the parallels of 43° and 44° , and at $3^{\circ} 45'$ of longitude west of Cape Finisterre (about 53 leagues), this ship experienced an easterly current, equal to 26 marine miles. Her position being directly opposite to the line of the southern coast of the Bay of Biscay, it is a fair conclusion that, the current was occasioned by the cause above-mentioned; or, as seamen call it, the *indraught* of the Bay; which, it appears, extends to at least 53 leagues from the shore. And as the rate, in this place, exceeds one mile per hour, it may be supposed, that the effect extends to a still greater distance.

"It may here be remarked, that the same ship, in coming out of the *Chops* of the Channel, a few days before, was *set* 24 miles to the westward, 15 to the northward, in the course of the 24 hours; that is, 38 miles, in a direction of N.W. by W. This may be supposed to be the same stream of current in its course from the *Bay* toward Scilly.

"II. The second fact, is that of the *drift of a bottle*, which was thrown out of a Danish ship (I believe sent on discovery), since the publication of the former paper.

"The bottle was thrown out in lat. $44\frac{1}{2}^{\circ}$, long. 12° West from Greenwich; that is, about 48 miles to the N.E. of the Cornwallis's station, at the time that she began to feel the current, on the 11th of March. It was taken up by a sentinel on duty, near Cape Ortegal, and, as was supposed, at the moment of its driving into the surf. If this was really the fact, the bottle, according to the date of the letter contained in it, must have been carried, at the rate of half a mile per hour, in the direction of about E. by S. $\frac{1}{2}$ S.; the distance was about 64 leagues.

"The report of this circumstance was transmitted by the French consul at Corunna, to the Academy of Sciences at Paris.

"It may be observed, that the drift of the bottle was much to the *south* of east; whereas, that of the Cornwallis was east; that is, both pointed toward Cape Ortegal, or its vicinity; as if the main stream of the current was concentrated there.*

"With respect to the velocity of the current, in the present case, all, of course, depends on the time of the arrival of the bottle at the shore. It might have been thrown up long before it was seen, and washed off again, by the tide, or surge of the sea. The *direction*, the most important point, cannot be questioned.

"III. The third fact is very simple, and perfectly conclusive. Off Cape Ortegal, at a considerable offing, Admiral Knight found the current, at the rate of one mile per hour, setting to the E.S.E.; that is, nearly *along-shore*.

"The reader will immediately perceive that these three facts converge, as it were, to one

* It is observed that, in the mouth of the Strait of Gibraltar, between Cape St. Vincent and Cape Cantin, the currents point in all directions, between S.E. and N.E. toward the entrance of the Strait, which may be considered as the pipe of a funnel.

point; that is, in the proof that the waters of the Atlantic flow into the Bay of Biscay, along the north coast of Spain.

"It would seem that the north-westerly current, by Scilly, did not, at least, in many cases, balance the easterly current round Cape Ortegal and the land of Finisterre.* The loss of his Majesty's frigate Apollo, with most of her convoy, may surely be attributed to the operation of this current. Captain (afterwards Commissioner) Wallis assured me, that, after having made, as he supposed, ample allowance for clearing Finisterre, yet, in the night, he had a very narrow escape from shipwreck. Very many others have been brought into the same kind of danger: so that the land of Finisterre, were it not discernible at a considerable distance, and its offing clear of rocks and shallows, and, moreover, situated in a finer climate, would prove a kind of Scilly to mariners.

"I have not been able to obtain any proofs, on record, concerning the course of the current round the Bay of Biscay. I formerly collected some information from a French commander respecting it. He said, that the setting of the current along the coast of France, to the north and north-west, was a fact well understood; and even acted on by many, in the choice of the *tack*, on which the current gave the greatest advantage, with dead winds.†

"One circumstance, and that a very striking one, in respect of this particular, is, that the soundings in the Bay of Biscay show little or no *muddy bottom*, to the southward of the Gironde river; but every where to the northward. This seems to show that the mud of the Gironde, Charente, Loire, &c. &c. is all carried to the northward; and by what cause, but a northerly current? Had the motion of the sea been variable, the mud would surely have been distributed to the south, as well as the north, of the mouth of the Gironde. The alluvial *embouchures* of the rivers in general, here, and the positions of the banks formed by them, in the sea, point to the North or N.W.; apparently the effect of the same sea-current.‡

"IV. In continuation of this current along the Bay of Biscay, I shall next mention, that Captain (afterward Admiral) JOHN PAYNE assured me, that, being in His Majesty's ship Russell, in a severe gale of wind at S.W., and with the ledge of rocks called the *Saintes* not far to leeward, he was under apprehensions for the safety of the ship during a whole night, but, to his surprise, found himself carried clear of the danger by a current, which set the ship, in all, about 70 miles to the north-west.

"V. The flowing of the tides, on the west of Scilly, cannot well be accounted for, on any other supposition, than that the flood is prolonged by a southerly current. The flood-tide is known to run nine hours to the northward; but the ebb, in the opposite direction, only three hours. This particular had not come to my knowledge, when the Paper of 1793 was written.

"VI. But the most satisfactory proof, not only of the *existence* of a *northerly* current,

* Nor, admitting an equal rate, in both places, could it well be. For the current enters the Bay of Biscay in an *east* direction, but goes off from it *north-west*. So that, if a ship was carried fifty miles to the N.W. from Ushant, she would only have made about thirty-five westing; but, in the other case, she would be carried the *whole* fifty eastward, toward the Bay and Cape *Finisterre*.

† After the above was written, the Author received the following important communication from Captain Wm. King, R.N.

Returning from India, a passenger, in February, 1797, in a merchant-ship, he was captured by a French privateer. Intending to take the port of Passage, in Spain, which is known to be near to Bayonne, in the very bight of the Bay of Biscay, she had arrived to within four miles of the entrance, when nightfall and the want of a pilot compelled her to stand off shore; a most violent gale of wind came on, blowing right on the shore, and which, blowing all their sails away, left them no hope of escape from shipwreck. They thus spent a miserable night, expecting every moment to be their last, and wondering at their prolonged existence: but, when day-break appeared, they found themselves so far off shore, to the N.W., that it was barely visible from the deck. Captain King remarks, that the N.W. (or northerly) current must have been very strong, in order to have counterbalanced so great a drift, and to this he attributed their safety.

‡ From a view of the Chart of Soundings between Spain and Ireland, one might be led to suppose, that the deep water and steep shore along the north coast of Spain, had been *partly* occasioned by the water driven in from the Atlantic, in westerly storms, along that coast; and which had gradually worn away the matter *there*, and deposited it on the bank which extends from Bayonne to the westward of Ireland. For the bank seems to expand, as it goes northward, in like manner as the current: and the water is shallower than might be expected, in proportion to the depths farther in.

athwart the mouths of the British and Irish Channels, but also of its *velocity*, (at least during certain intervals,) is a statement in a book published in 1733, entitled JOSHUA KELLY'S Treatise of Navigation (in two volumes octavo). This case is the more satisfactory, as it happened in a *dead calm* of forty-eight hours' continuance: so that all uncertainty, regarding the accuracy of a *sea-reckoning*, allowances for *leeway*, *drift*, &c., is precluded; since the changes of position that took place could only have been effected by the motion of the sea, either in the nature of a *current* or of a *tide*; and this latter must be placed out of the question, since the interval of time included no less a space than that in which four *fluxes*, and as many *refluxes*, have their periods: so that they may well be supposed to balance each other.

" 'It has been observed,' says MR. KELLY,* 'by an experienced commander, who used the West-India voyages for many years, from England, (in his return from one of these,) that, in about the latitude of $48^{\circ} 30'$, open with our British Channel, having a good observation (of latitude) at the same time, it proving calm and smooth water, insomuch that he handed his sails, and so lay forty-eight hours. The first twenty-four hours, at noon, he observed the latitude again, with clear weather, and found by the same that he had *drove to the northward twenty miles*: which made him distrust his former observation, though his mate agreed with him; because the ship had not gone, to his knowledge, one mile; and, upon review, he found that he was not mistaken. The next twenty-four hours, being still calm, he had again another good observation; and then found himself about twenty-six miles to the northward of his last observation; which confirmed him that he was right the day before; and that this must be imputed to a strong northern indraught, or current, there. For when you come near the soundings, and till you bring Ushant south of you, on the E.S.E. course,† *you will hardly hold your latitude*; and the general course is E.N.E. or E. by N.; if but a small matter to the southward of latitude 49° . And he says, that would have been my course, if we had not met this opportunity of discovering this strong indraught: and, from want of observation, [*i. e.* if he had not known the latitude,] must have run up St. George's Channel, or the North Channel, as many have, and still do, from want of the same [information].

" 'After his last observation, the wind sprang up; and, making allowance for the said indraught, [*i. e.* in his future course,] the next day he was brought into soundings; and the following day he was brought in sight of the *Lizard*, by steering to the southward of the east.†

" It will naturally occur to the reader, that, although this case gives the *northing only*, yet that, in respect of the main question, which is, the danger of shipwreck on Scilly, or of being carried into the Bristol Channel, it is sufficient to prove a conviction of the necessity of attending closely to the ship's course, when on the point of entering the English Channel, after, or during, a course of strong westerly or south-west winds. But it would, doubtless, have been more satisfactory, had the *direction* of the stream been known. Had that been *north-westerly*, as I have before supposed, the rate of velocity must have been more than a mile and a quarter *per hour*; or approaching to one and a half (the northing being twenty-three at a mean in the twenty-four hours); whilst that in the Atlas East-Indiaman, recorded in a former Paper, was about one mile *per hour*, during four days, consecutively.

" The statement in MR. KELLY'S book, which is, indeed, altogether more brief than could be wished, is also defective through the want of the distance sailed, from the place of the last observation for the latitude, to that from whence they saw the Lizard Point. They had their first soundings the day after that observation; and on the following day they saw the Lizard. His course appears to have been regulated with a view of preserving, nearly, his parallel of $49^{\circ} 16'$; to which he had been carried by the current. It is not likely that he sounded to any great depth; perhaps 70 fathoms; which in that parallel might have been about 20 leagues south-west from Scilly: and it does not appear that he considered himself in soundings when the calm began; which, however, it is probable he was, although in deep water.‡ Accordingly one may conceive that his position, *at the end of the*

* Volume the first, page 434.

† These are *compass* bearings. The magnetic variation, at that time, being about a point and a half westerly, these will be respectively E. $\frac{1}{2}$ S., N.E. $\frac{1}{2}$ E., and E.N.E. $\frac{1}{2}$ N., true.

‡ Meaning, no doubt, the E.S.E. course, by compass, as above, or true E. $\frac{1}{2}$ S.

§ Perhaps 30 or 35 leagues to the west of Ushant, and in about 100 fathoms.

calm, might have been about the meridian of Cape Clear, or somewhat to the eastward of it. It must be recollected, that, in running toward the Channel, after the calm, he had still to encounter the same adverse current; and that, possibly, to within 30 or 40 miles of his seeing the Lizard.

“ But whether his position, during the time that he was under the influence of the current, be a degree more or less to the eastward, the fact bears the same on the main question; since a ship, in crossing the stream, wheresoever it may be situated, must have been carried out of her reckoning, and thereby placed in danger; in the event of thick weather happening subsequently, and preventing their setting themselves right by an observation of latitude.

“ His idea, of the eastern edge of the stream, is worth remarking; as it approaches, in a general view, to the truth. It was, that in *about* the parallel of 49° , it approached to the meridian of Ushant. And with respect to the *direction* of the stream, as he calls it a *northern indraught*, he certainly concluded that it ran to the northward, into the St. George's or Irish Channel, brushing the west side of Ushant and the Land's End. And the effect of the current on his ship was, no doubt, such as to warrant that belief, with those whose knowledge of the subject was confined to the mere effect of setting them to the northward of Scilly and into the mouth of the Bristol Channel.

“ The information contained in this statement does not even terminate in the mere facts of the existence and force of the current. The commander of the West-India ship is said to have made *many voyages* to and from that quarter; and his narrative shows him to have been an *observant man*. Yet he was ignorant of the existence of such a current, until the case occurred which has been just stated. This then alone may serve to show, very satisfactorily, that the current does not exist in strength but at certain intervals; and therefore operates in a more dangerous, because a treacherous, manner.

“ Had it constantly prevailed, like that round the Cape of Good Hope, &c., it could not have escaped detection; and, in consequence, few or no evils would have ensued: but these effects being only felt casually, they were considered as mere contingencies, arising from wind and weather, as in other parts of the sea; and not as resulting from a fixed cause, always operating, although in very different degrees; since no person at that time had collected the different cases, with a view to examine and to compare them. Some, indeed, referred it to the indraught of the Bristol Channel; without considering that, if such a power existed at all, it was difficult to conceive how it could be suspended, and why it should not operate at all times.

“ Our navigators, in earlier times, appear to have entered the English Channel on a more southerly parallel than they have done in latter times. For, although they might have been ignorant of the real cause of the disturbance in their course, yet many of them believed that there was an *indraught*, as they called it, into the St. George's Channel; so that one effect of the current, that is, the *northern set*, had not passed unobserved, although the *cause* was not understood; nor, of course, could it be known when to expect it. But I have also heard it remarked by sea-officers, as long ago as I can remember, that ‘it was unaccountable what should occasion their *running down so much distance*, in coming in with the land from the westward.’ I never heard, however, that there was any suspicion of a current setting westward.

“ The idea of a northern *indraught* into St. George's Channel (but which applies equally to the current west of Scilly) is clearly set forth, in a publication by Captain Joseph Mead, in 1757; but which came to my knowledge only very lately, by the favour of Mr. Purdy. Captain Mead first relates the case of the ship *Hope*, of Liverpool, bound from the coast of Guinea to that port, in November, 1735. (Preface, page iii.)

“ ‘ Having had a good observation, by which they found they had the Irish Channel open, the wind continued to blow strong from between the south and west, but mostly from the former. Having no other observation [of latitude] for six days, in which time they carried sail constantly, they by reckoning expected to fall in with Cape Clear: but in the following night they fell in with the *Blasquets*.’ These islands and rocks are situated in lat. $52^{\circ} 10'$, or about 48 miles to the north, and one degree of longitude to the westward, of Cape Clear.

“ Again (page 10) he says, that the Bristol merchant-ships, which fall in with Cape Clear, on their homeward passage [from the West-Indies, &c.], shape their course from thence, with a large wind, to the high land near *Padstow*; which is the land they choose

to make to lead them to the entrance of the Bristol Channel. That, in estimating this course, they allowed four or five degrees in the bearing, to compensate for the indraught into St. George's Channel. This angle would give about 13 or 14 nautic miles; and is probably what they found by experience to be the general amount of the *northern set*.*

"He goes on to say that, in like manner, the safety of ships, after they come into soundings, until they reach Scilly, depended on their making *no less allowance* than the Bristol men do in the other channel. For, says he, 'experience informs me that, from the commencement of soundings, in lat. $49^{\circ} 30' N.$ to the length of Scilly, in *fair weather*, I had found the northern indraught to be six or eight miles in the twenty-four hours.'"

Here, then, the fact of the *northern set* is a second time recognized; though without any suspicion, any more than before, of there being a *westerly set* also.

Here it may be proper to state, what appears to me to be a very important fact; although perhaps not connected with the current in question, but materially affecting the safety of the navigation between the English Channel and Dublin. It was communicated to the author by Captain Evans, a gentleman who superintends the harbour-works at Holyhead, and who has had much experience in the navigation of the Irish Sea.

"All navigators, (says he,) in their voyage from the Land's End to Dublin, find themselves more or less carried to the eastward, whilst running up St. George's Channel; which is the cause of so many vessels finding themselves in Cardigan Bay; where, in tempestuous weather, and westerly winds, many have been lost. And this he justly supposes to be occasioned by a current setting to the north-eastward."†

FURTHER DEMONSTRATION.—To the preceding development, by Major Rennell, we may, with propriety, add a notice of the loss of *La Jeune Emma*, of Cherbourg, commanded by Chacelot de Chatillon, in the night of Nov. 28, 1828; an extraordinary and memorable instance of the operation of the current. This vessel, of about 400 tons, from Martinique, was bound to Havre de Grace, with colonial produce. She had, in her passage, encountered several severe gales, (we presume from the S.W.) and had shipped two heavy seas. On advancing toward the English Channel, the weather was hazy, and thus continued for *several days*, so that no observation could be taken, and the reckoning consequently became erroneous. At length a lighthouse was seen, supposed by the captain to be that of *Ushant*, and a course was shaped accordingly: but this unhappily brought the vessel to the

* Although they might not have known at that day the *true* latitude of Cape Clear, yet it may reasonably be supposed that they knew the quantity of the *difference of latitude* between Cape Clear and the high land of Padstow; as it was so necessary to their purpose, and so easy to be obtained.

† We have assumed the liberty of giving a very long extract, with regard to the current, as it sets athwart the Channel; but it is requisite to notice that, the venerable author, after establishing this fact, has given some further remarks on the currents, in general, about the British Isles; all of which, it is almost superfluous to state, are worthy of the mariner's attention.

From subsequent communications, it has been shown that the water sets into the Bay of Biscay from the N.W. as well as the West, at times as high as the parallel of 47° ; and it is supposed that a *whirl* is sometimes formed by the outer part of the water, that the Bay discharges to the N.W., turning to the West, and round to the South and S.E., while the inner part shoots to the N.W. and W.N.W. Hence it may be concluded that, when the volume of water received, and, of course, the velocity is very great, the whirl to the left or West is farther removed to the N.W., and the contrary.

Of this current Captain Livingston says, "I have seen, in a late Magazine, some one alleging that Rennell's Current, athwart the Channel, is imaginary. I know the contrary, from experience, and perfectly remember, that, in 1813, while master of the *Lark* sloop, I was set one day 24 minutes North of dead-reckoning, equal to one mile an hour, but can say nothing as to the westing. On coming lately from Bordeaux, 1819, we were set by it 17 minutes North in 24 hours; but, as a passenger, I had, at this time, no opportunity of keeping a reckoning."

On the 13th of July, 1826, the ship *Carshalton Park*, Capt. J. S. Park, entered upon the Bank of Soundings on the parallel of 49° , and between the meridians of 11° and $9^{\circ} W.$ '*Rennell's Current*' was then found to be setting with dangerous strength. The ship crossed it rapidly; running all the time at the rate of 7 knots, but was swept 14 or 15 miles to the N.W. by W. It had been previously ascertained that no current existed, nor was any found eastward of $9^{\circ} W.$ The wind was between S.W. and N.W. flying about in squalls.

At 9 a.m. on the 14th, Captain Park made the Lizard, bearing N.E., and had the satisfaction to find his chronometer perfectly correct.

INSET INTO THE BAY. Capt. Geo. Cheveley, June, 1830. Latitude 52° to 47° , long. 12° ; current E.S.E. half a mile.

Lat. 47° to 44° , long. 12° to 11° ; current E.S.E. three quarters of a mile.

Cefn Sidan Sands, within the *Bar of Caermarthen Harbour*, and she next day became a total wreck. The captain and passengers were drowned, and from a crew of nineteen only six were saved.

The narrative states that there is not, perhaps, a beach of this kingdom, where there is a more furious sea running, during the prevalence of south-westerly winds, than *Cefn Sidan Sands*, nor any which has proved more imminently disastrous to those who have been so unfortunate as to have been driven on them.

The event proved that the lighthouse, which had previously been supposed to be that of *Ushant*, on the French coast, was really that of *Lundy Island*, in the Bristol Channel! The latitude of *Lundy lighthouse* is $51^{\circ} 10'$; that of *Ushant* $48^{\circ} 28'$. The difference of latitude between the two is, therefore, $2^{\circ} 42'$ or 162 miles: a difference surely too great to have been effected by merely ordinary circumstances, but which may, in the absence of positive information, be assumed, as a presumptive proof of the operation and strength of *Rennell's Current*.

Notwithstanding, however, all that has been said and written upon this subject, *Captain Martin White*, from his experience on the Channel Soundings, &c. has given it as his opinion that the North-westerly outset from the Bay of Biscay may be accounted for as the operation of *Tide*, independently of *current*. He presumes, from his observations, that the principal portion from the Atlantic, which fills the English and Irish Channels, comes in the first instance from the northwestward, but that the tide of flood enters the Bay in greater proportion from the westward than from the northward; the main body of it being directed principally toward Bayonne, in the S.E. corner of the Bay. Secondly, that it varies its direction northeasterly and northerly as the water in the Bay accumulates, and the indraught consequently decreases; and that the stream, from the configuration of the coast, will set out from the Bay with much greater influence in a northerly than a westerly direction," &c.: but, let it be considered that, if the stream were merely a tidal stream, rising from a fixed cause, always operating, more or less, it would be regular, though modified according to the winds. It must be allowed that both tide and current, in the first instance, certainly set into the Bay in one direction, that is from W.N.W., and it seems that the influences of the sun, moon, and wind, are combined to produce the outset.

EXPERIMENTS ON THE CURRENT.

INSET INTO THE BAY OF BISCAY.—A bottle from the *Lady Louisa*, bound to St. Michael's, in lat. 45° , long. $13^{\circ} 45'$, 2nd Feb. 1830, found on the coast of Lit, in the province of Bayonne, 14th of October, in the same year.

CHANNEL SOUNDINGS INTO THE BAY.—Bottle from the brig *Hope*, from Havanna, 31st March, 1838, in latitude $50^{\circ} 10'$, long. $9^{\circ} 43'$; wind *strong from the eastward* for three days; found on the 1st of June, 1838, on the coast of Rochefort; having probably been first impelled to the S.W. by the ebb tide and prevalent wind, and thence following the general inset to the South and East.

QUERY.—“Why should the sea be higher, or more dangerous, in the Bay of Biscay, than it is in the middle of the Atlantic or elsewhere? Is it really so? Are questions often asked.

“I believe that there is a shorter, higher, and consequently worse sea, in and near the Bay of Biscay, than is often found in other places, and attribute it to the effect of immense Atlantic waves, rolling into a deep bight, where they close upon each other, and receive vibratory undulations from each shore; augmented, perhaps, by the peculiar formation of the bottom of that bay, the variation in depth, and the effects of currents, which, when running over uneven ground, or against the wind, alone cause a heavy swell; a striking exemplification of which may be seen on the Bank of Agulhas, near the Cape of Good Hope.”—*Captain Fitz-Roy*, vol. ii. 45.

FROM CHANNEL SOUNDINGS TO THE WEST OF SCOTLAND.—A bottle thrown from the ship *Duke of Marlborough*, Captain Jeffery, by Mr. George Thom, near the Sole Bank, in latitude $48^{\circ} 38'$, longitude 9° W. Found on the shore of Carsaig, near the middle of the south side of the island Mull, 14th of April, 1821, and made known by Mr. Hector Maclean. At the time this bottle was thrown into the sea, the ship was on its passage to London from the Cape of Good Hope, and an allowance was made for current to the N.W. of 12 miles to the 24 hours. From the spot in which it was dropped, it seems unquestionable that the bottle

bottle was carried by the current to the west and north of Ireland, and thence between Ila and Mull, to the place in which it was found. It has, therefore, well answered Mr. Thom's purpose of "confirming Rennell's Current."

BAY OF BISCAY to the NORTH of SCOTLAND.—A bottle, enclosing a song composed on board, from the *Great Western* steamer, on her voyage to New York, at midnight of Sept. 10, 1838, in latitude $48^{\circ} 3' N.$, long. $9^{\circ} 52' W.$ Picked up by Captain Thornton, of the *Ceres*, in passing through the Pentland Frith, on the 16th of the same month. It must, therefore, have drifted to the northwestward and northward, off the western coasts of Ireland, and thence to the N.E. and East, by the general drift from the Greenland Seas.

ST. GEORGE'S CHANNEL.—A bottle from the ship *Osprey*, of Glasgow, Alexander M'Gill, master, which sailed from Greenock, on the 20th of February, 1820, on a trading voyage around the world. This bottle (No. 310) was thrown into the sea 1st of March, 1822, on the ship's return from Calcutta, in latitude $49^{\circ} 54' N.$, and longitude $12^{\circ} 20' W.$; it was found on the shore, upon the south side of Milford Haven, on the 6th of the following month, April; and the notice was thence transmitted to the Admiralty.

EASTERLY CURRENT TO BRISTOL CHANNEL.—A bottle from the brig *Albert*, R. L. Robertson, master, latitude $47^{\circ} 20' N.$, longitude $22^{\circ} W.$, 24th January, 1822, on the passage from Virginia to England, the wind then about W.N.W., and had so prevailed for two or three days. Found in Rockam Bay, about 4 miles west from Ilfracombe, 29th of July, 1822, and attested by the agents to Lloyd's.

BAY OF BISCAY, NORTH SIDE.—A bottle from the ship *Graham Moore*, 6th of July, 1821, in latitude $47^{\circ} 47' N.$, longitude $7^{\circ} 51' W.$ Found, 15th of September, 1821, on the coast of St. Jean de Mont, arrondissement of Sables d'Olonne, department of La Vendée; and made known by the '*Journal de Paris*.' This bottle was impelled in an E.S.E. direction, the north-westerly current not then prevailing, and was within the influence of the *tide*.

By Captain Livingston's Journal, 28th November, 1820, "It appears that in 24 hours, ending at noon of yesterday, (on the passage from Gibraltar,) we made about 15 miles North by current; and in 24 hours ending at noon this day about 13 North, and in the two days rather more than $20' E.$ Therefore about N. $40\frac{1}{2}' E.$ 37 miles in the 48 hours.

INSET TO, AND OUTSET FROM, THE BAY OF BISCAY.—A bottle from the *Iris*, Captain Skinner, in latitude 47° , long. 21° ; 9th Sept. 1802; found at the Isle of Skie, (lat. $57^{\circ} 15'$, long. $6^{\circ} 20'$) 22nd Febr. 1803. (Probably carried into the Bay on an Eastern direction; subsequently northward by Rennell's Current, and thence by the Eastern Drift to Scotland.)

The ship *Jessie*, Bevan, master, left London for the Bahamas, about the 13th of Nov. 1833. She was struck by lightning and abandoned by her crew, in latitude 45° , long. 14° , and, on the 5th of Feb. 1834, drove on the *Isle Groix*, near L'Orient, and was immediately dashed to pieces.

INSET; BAY OF BISCAY.—A bottle from the *Curshalton Park*, Lieut. J. Steele Park, 27th July, 1827, in lat. $48^{\circ} 39'$, long. $10^{\circ} 21'$, taken up, 21st Dec. 1827, on the shore of Penbron Road, near the Loire, in the Bay of Biscay, lat. $47^{\circ} 19'$, long. $2^{\circ} 30' W.$

A bottle from H.M.S. *Arrow*, in lat. $48^{\circ} 30'$, long. $9^{\circ} 25'$, 14th July, 1838; wind from S.W. for five days, a fresh gale, and then S.W. Another bottle from the *Maitland* transport, in lat. $49^{\circ} 5'$, longitude $18^{\circ} 19'$, 10th of March, 1838. Both found, on the 25th of Feb. 1839, on the shore of Arcachon, in the Bay, latitude about $44^{\circ} 40' N.$

A *metal cylinder*, cast from H.M.S. *Chanticleer*, Capt. H. T. Austin, 3rd of May, 1831, in latitude $44^{\circ} 38\frac{1}{2}'$, long. $11^{\circ} 4' W.$; found near Vivero, on the north coast of Spain, 12th of September following, and at about 150 miles from the spot where it was dropped into the sea.

A bottle from the bark *Mary*, of London, Abyah Locke, master, 12th of April, 1832, in lat. $48^{\circ} 30'$, long. $16^{\circ} 56'$, found on the coast of Jart, lat. $46^{\circ} 25'$, 4th March, 1833.

Another bottle, from the same vessel, 17th April, 1832, in lat. $46^{\circ} 15'$, long. $17^{\circ} 58'$, found near Cape Feret, lat. $44^{\circ} 38'$, 21st Feb. 1833.

TIDE WATER ON SOUNDINGS.—A bottle from the barque *Wallace*, of Alloa, bound to Van

Van Diemen's Land, 12th of April, 1835, in lat. $52^{\circ} 13'$, long. 15° . Picked up at 5 miles from Ushant, 21st August, 1835.

A bottle from the *Kent*, troop-ship, in lat. $50^{\circ} 20'$, long. $19^{\circ} 0' W.$, August 19, 1836. Picked up near Cape Blanez, a few miles from Boulogne, Dec. 20th, in the same year.

BAY OF BISCAY, SOUTH SIDE.—A bottle from the schooner *Morning Star*, of Liverpool, Captain Andrew Livingston, 7th of October, 1821, lat. $42^{\circ} 45' 39'' N.$, long. $13^{\circ} 3' 21'' W.$ Found about 29 miles to the northward of Bayonne, in the arrondissement de Dux, latitude $43^{\circ} 58' N.$, longitude $1^{\circ} 20' W.$, and made known by the direction of the Minister of the Marine and Colonies of France, in the '*Moniteur*' of January 24, 1822. To his Excellency, and the Baron Seguier, Consul-general of France in England, we are indebted for this information, and for the original document, addressed by our friend, to the editor of this work.

NOTE.—*These bottle-experiments are vague; they prove nothing as to the irregularities or the velocity of the current: it cannot be known how long the bottles may have laid on shore undiscovered: but still they show, when uniformly found to have set in nearly one direction, the general tendency of the drift, or current, on the surface of the ocean; and have thus been very useful.*

One of the most singular routes of the kind that we have met with was a bottle, covered with barnacles, picked up at the Mizen Head, on the S.W. of Ireland, October 19, 1837. Its enclosed note stated that it was dropped off Cape Horn, from the *Salem*, R. Cruikers, master, of the United States, in latitude $53^{\circ} 3' S.$ and longitude $67^{\circ} 5' W.$, on the 24th of June, 1830.

2. The ARCTIC or GREENLAND CURRENT, with EASTERLY and S.E. DRIFT-CURRENTS to the Coasts of EUROPE and AFRICA.

Born the great easterly and westerly motions of the waters of the Atlantic may be traced to very remote causes. The *Equatorial Currents*, as hereafter shown, may be clearly traced from the Indian Ocean, and around the Cape of Good-Hope, to the Brazilian sea. Those of the *northern regions*, may, in like manner, be traced from the Polar Seas, Hudson's Bay, and Davis's Strait. The latter, in their progress, on the west, winding about the coast of Newfoundland; and, toward the East, setting eastward and E.S.E., to the Bay of Biscay; more to the southward along the coast of Portugal, and more to the northward, toward and along the Western Isles of Scotland, &c. In the Summer, more constantly in these directions; in the Winter, more variable and less southerly.

This scheme of a *general* predominance in the motion of the waters is grounded, not upon any questionable theory, but upon incontrovertible facts. The evidence of a powerful southerly current setting at times, if not always, between Iceland and Greenland, is shown in our '*Memoir, &c. on the Northern Ocean*,' pages 56 and 112: the currents from Hudson's and Davis's Straits are also described in the same work, page 61.*

For the origin of the Currents which fall into Baffin's Bay and Davis's Strait, Captain Dundas Cochrane adverts to the Polar Sea, which washes the northern coasts of North America. "Every expedition," says he, "which has been sent from this country up Baffin's Bay, Davis's Strait, Hudson's Bay, as also that under Captain Franklin, has noticed the perpetual currents setting from the Polar Basin into Baffin's Bay; Captains Ross and Parry found them upon the first, as did the latter on his last two, voyages, at the rate of three and four miles an hour. I believe that there can be but little doubt that, from Hudson's Bay to Lancaster's Sound, there is an endless variety of channels and straits which must form currents; and the more numerous and contracted those channels are, the greater the difficulty of stemming them. It is, indeed, miraculous how the ships have been so often saved from being dashed to pieces, crushed to atoms, or run down by icebergs, from thus sailing in opposition to the stream.

"Upon the other [the western] side of America we have the voyages of Cook, (or more

* Impelled by Currents from the North or N.E., during the spring of 1827, the North and East coasts of Iceland were visited by an extraordinary number of icebergs, which produced so much cold and drought, accompanied by furious gusts of wind, that vegetation was at a stand. By way of amends, the fishery, especially on the southern parts of the island, was exceedingly productive.

properly of Clerke,) of Kotzebue; and, lastly, of the Russian expedition under Captain Vasilieff. Currents were found by these three navigators setting to the North, N.E., and E.N.E. The voyage of the latter is, however, more in point: the commander of that expedition told me, at Kamchatka, that so strong was the E.N.E. current, after his fast-sailing sloop had got round [beyond] Icy Cape thirty miles, he was afraid to continue lest he should not be able to get back; considering, as Captain Vasilieff did, that it would be imprudent, if not dangerous, to winter upon the north coast of America, separated from his consort; the latter being employed in surveying the N.E. coast of Asia, &c.

"All authors, all judges, all persons who have made inquiries upon the subject, admit of a current setting from the Pacific into the Polar Sea, (toward Autumn at least,) by way of Behring's Strait, as well as a current from the Polar Sea to the Atlantic Ocean, by way of Baffin's Bay.

"The currents observed by Captain Franklin, and strengthened by the drift wood being *always* to the westward of the headlands, prove, beyond a doubt, that, in these regions, no western current ever takes place."*

These remarks satisfactorily illustrate the cause of the current which so powerfully sets to the southward from Hudson's Strait, &c. thence to the Strait of Belle Isle and Coast of Newfoundland. On the eastern coast of the latter, spreading over the ocean, it appears to come from the north-eastward; sometimes with a velocity of two miles an hour. Its strength, however, varies with the direction and force of the wind. Passing down the eastern coast of Newfoundland, it turns round Cape Race, and sets thence along the south coast of the island, until it meets with the St. Lawrence current, a little to the westward of Miquelon Island, as shown hereafter.

STRAIT OF BELLE ISLE, &c.—It has been remarked, by Captain Bayfield, that a branch of this current, setting inward through the Strait of Belle Isle to the Gulf of St. Lawrence, is confirmed by the presence of icebergs which it transports into the Gulf every summer, against the prevailing S.W. winds; frequently carrying them as far as Mecatina, and sometimes even to the vicinity of the east point of Anticosti. Its strength is very much increased by a prevalence of N.E. winds; at such times it runs at the rate of two knots, through the Strait, and for 30 or 40 miles farther to the westward; diminishing gradually in force as it spreads out in the wider parts of the Gulf. Usually, however, its rate is much less; and, at times, when S.W. winds prevail, it becomes very weak and imperceptible.

From the mouth of DAVIS'S STRAIT on the East, it has become clear, from various experiments, that the predominating current sets to the eastward. Of the bottles thrown into the sea from the ships commanded by Captains Ross and Parry, in 1818, one was found, dated 24th May, on the Isle Bartragh, Killala Bay, Ireland; another, dated 29th May, about three miles from Innishowen Head, near Urris, on the west of Ireland; another, dated 3d of June, was found at Balnarlald, North Uist, one of the Western Isles of Scotland. The times in which these were found were June, July, and August, 1819; it is impossible to describe the course of these bottles, or how they were impelled by the winds; and such facts are recorded merely from the want of better data.

What may be the *general* direction of the predominating current from and about the North Cape of Europe we cannot say; but we are certain that, it is very common for ships from England, outer bound, to be far astern of the reckoning; and that, in proceeding toward the White Sea, in the spring, they meet with great drifts of ice from that sea, as shown in our "*Memoir, &c. on the Northern Ocean.*" Immense ice-bergs were seen off the coast of Denmark, in January, 1820, supposed to be fragments of larger masses, rent from the North.

Other experiments on these currents have been made as follow:—

ICELAND TO THE FRITH OF CLYDE.—A bottle from the Merioneth, whale-fisher, R. Morris, master, 27th July, 1820, in latitude $62^{\circ} 10'$, and longitude $19^{\circ} 30'$. Found

* Arguments in favour of an Expedition for exploring the North Coast, commencing with Behring's Strait, by Capt. John Dundas Cochrane, R.N.—*New Monthly Magazine*, 1st May, 1824.

These arguments have been strengthened by the general observations on the Winds and Currents of the Polar Sea, by Captain (now Sir John) Franklin and Dr. Richardson, made on the expedition of 1825, 6, and 7; also by those of Captain (now Sir Wm. Edw.) Parry, in his attempt to reach the North Pole from the Sea of Spitzbergen.

on the 4th of September, 1820, by John Lamont, a fisherman of Bute, near the Cumrays. In the month of August, therefore, this bottle was carried by the current, in a south-easterly direction, to the North Channel of the Irish Sea; and thence, by the tide of flood, to the entrance of the Clyde.

GREENLAND TO TENERIFE.—A bottle from the ship *Hecla*, Captain Parry, 16th of June, 1819, in latitude $58^{\circ} 13' N.$, longitude $46^{\circ} 55' W.$ Found on the S.E. shore of Tenerife, 29th of July, 1821, and the notice was transmitted to England by Messrs. Pasley, Little and Co.

NORTHERN OCEAN TO THE CANARY ISLES.—A bottle from the *Camillus*, of Greenock, in the winter of 1830, about 130 leagues to the N.E. of Newfoundland. Picked up at the Grand Canary, 19th of April, 1832; and thus proving the vast extent of the drift-stream from the Arctic seas.

HUDSON'S STRAIT TO IRELAND.—A bottle from H.M. ship *Fury*, Captain Parry, July, 1821, in latitude $62^{\circ} 8' N.$, and longitude $62^{\circ} 27' W.$ Found 9th of March, 1822, on the shore of Iris, county of Donegal, Ireland, latitude $55^{\circ} 15'$, longitude $7^{\circ} 28'$; and thence transmitted to the Admiralty.

DAVIS' STRAIT TO IRELAND.—A bottle from H.M.S. *Alexander*, Captain Parry, in latitude $62^{\circ} 5'$, longitude $54^{\circ} W.$ 29th of May, 1818. Found off the N.W. part of Donegal, 15th of July, 1819.

DAVIS' STRAIT TO SCOTLAND.—Another bottle from the *Alexander*, latitude $59^{\circ} 8'$, longitude $52^{\circ} 19'$, 27th of May, 1818. Found 28th of July, 1819, near the Isle of Staffa.

DAVIS' STRAIT TO SCOTLAND.—Wreck of the *London*, latitude $61\frac{1}{2}^{\circ} N.$, longitude $57^{\circ} W.$, April, 1817. Discovered at the Orkney Islands, lat. 59° , 20th of March, 1818.

BETWEEN NEWFOUNDLAND and the CANARIES.—One of the most horrid cases of a ship *water-logged*, appears to have been that of the *Francis Spaight*, homeward bound, from St. John's, New Brunswick, 24th of November, 1835; nine days after which the vessel broached to in a gale, and lay a helpless log in the sea: sixteen days were then passed without the means of obtaining food from below, and until the *survivors* were taken off by the commander of an American vessel, the *Agenoria*. The *Spaight* was then abandoned, and ultimately drifted to the island Fuerta-ventura, one of the Canaries, into a port of which she was towed about the latter end of May, 1836.

NEWFOUNDLAND BANK TO BRISTOL CHANNEL.—A bottle from the bark *Sarah*, of Newcastle, off the Bank of Newfoundland, in latitude $46^{\circ} 2'$, long. $48^{\circ} 10'$, 29th of May, 1835. Found, almost covered with barnacles, near Porlock, on the south shore of Bristol Channel, 13th of April, 1836.

NEWFOUNDLAND BANK TO IRELAND.—A bottle from the Fredish ship *Elizabeth*, in latitude 47° , longitude $49^{\circ} 10'$, 15th of August, 1819. Found on the coast of Sligo, Ireland, 21st of June, 1820.

NEWFOUNDLAND BANK TO IRELAND.—A bottle from the ship *Hercules*, on the Bank, 24th May, 1837. Found at Iranmore, coast of Donegal, August 2d, 1838.

EASTERLY DRIFT TOWARD IRELAND.—On the 5th of April, 1834, a ship's boat was discovered, by an officer of the Preventive station, in Roundstone Bay, on the coast of Galway, high and dry on some rocks, at a short distance from the land. This boat, from her peculiar construction, was proved to have belonged to the packet *Thais*, Lieut. Church, from Falmouth to Halifax, 12th of December, 1833, and not since heard of. The current must, of course, have brought it from the West or W.S.W.

EASTERN DRIFT TOWARD IRELAND.—A bottle from the *Seine*, latitude $50^{\circ} 45'$, longitude $40^{\circ} 20'$, 18th September, 1811. Found on the coast of Kerry, S.W. of Ireland, (lat. $51^{\circ} 30'$) 18th of June, 1812.

EASTERN CURRENT TOWARD IRELAND.—A stone bottle from the *Ibbetsons*, of Stockton, on its passage from Pictou to Peterhead, 5th Nov. 1826, in lat. $55^{\circ} 30'$, long. $18^{\circ} 20'$. Picked up on the coast near Killala, 3d Jan. 1827.

EASTERLY CURRENT TOWARD SCOTLAND.—A bottle from the brig *Ardent*, John Duncan, master, from Hamburg to Newfoundland, 22nd of September, 1824, lat. $56^{\circ} 58'$, long. $24^{\circ} 30'$. Found 12th March, 1825, on the sands of Dell, near the Butt of the Lewis, and the notice transmitted by the agents to Lloyd's at Stornoway, 17th of March.

NOVA-SCOTIA TO IRELAND.—A bottle thrown into the sea, 20th of June, 1819, from H.M. ship *Newcastle*, in latitude $38^{\circ} 52'$, long. 64° (the meridian of Le Heve Bank). Found on shore in the Rosses, on the N.W. of Ireland, immediately in the vicinity of the Isle of Arran, by Mr. Nassau Forster. There can be no doubt that, near the coast of Ireland, the current blends with the flood-tide, which sets in from the S.W.

NOVA-SCOTIA TO FRANCE.—The bowsprit of H.M.S. *Little Belt*, which was dismasted on the Halifax station, about 18 months before. Picked up, 18th of February, 1811, near Basque Roads, in latitude 46° , longitude 2° W.

A wreck, from latitude 44° near Halifax, was once found in the Road of Aix; and a bottle, from latitude 49° , longitude 45° , came ashore near Cape Finisterre.

EASTERLY CURRENT TOWARD SCOTLAND.—A bottle from the *Sandwich*, of Dartmouth, Walter Squire, master, bound from Liverpool to Labrador, lying-to in a gale, 1st of June, 1821, in latitude $50^{\circ} 16'$ N., longitude $36^{\circ} 25'$ W. Found 2nd December, 1821, on the western shore of South-Uist, in the southern range of the Hebudes or Western Islands.

EASTERLY CURRENT TOWARD SHETLAND.—A bottle from the snow *Romulus*, Captain John Crawford, 27th of July, 1819, in latitude $57^{\circ} 47'$ N., longitude $20^{\circ} 42'$ W. Found on a beach called the Croe Air, upon the N.W. part of the Main Land of Shetland, by Charles Man, 14th of November, 1819, and made public by Mr. Gilbert Man.

NORTH OF SCOTLAND TO NORWAY.—A sealed bottle from the ship *Hecla*, dated 22d May, 1819, lat. $59^{\circ} 4'$, long. $6^{\circ} 55'$ W.—found 21st Sept. near the mouth of a river above Rød-ø, lat. $60^{\circ} 45'$, long. $4^{\circ} 54'$ E.

BETWEEN NEWFOUNDLAND and the ENGLISH CHANNEL.—A bottle from the *Royal Union*, from Quebec to Dublin, Dan. Grant, master, 27th Sept. 1822, dropped in lat. $48^{\circ} 15'$ N. long. $45^{\circ} 10'$ W. was picked up at Scilly, 11th Dec. 1822, and transmitted to Lloyd's.

BETWEEN NEWFOUNDLAND and the ENGLISH CHANNEL.—A bottle from the *James Cropper*, Capt. Marshall, from Liverpool to New York, 10th Jan. 1824, in lat. $48^{\circ} 20'$, long. $38^{\circ} 5'$; found 12th Feb. 1825, at Gunwallow fishing-cove, in Mount's Bay.

BETWEEN NEWFOUNDLAND and the ENGLISH CHANNEL.—A bottle from the *Three Sisters*, of Cork, Capt. Pollock, 30th of July, 1824, in lat. 41° and long. 42° , current then E. by S. $1\frac{1}{2}$ mile an hour. Found 12th Oct. 1825, in Guavas Lake, Mount's Bay.

INSET to the ENGLISH CHANNEL.—A bottle from the *Margaret*, of Glasgow, latitude 52° , longitude 24° , 1st March, 1821, picked up near Jersey. (*Date not given.*)

TOWARD the BAY of BISCAY, from the West.—A bottle from the *Sisters*, of London, C. Pittman, commander, 17th Sept. 1827, in latitude $44^{\circ} 8'$, longitude $36^{\circ} 56'$. Found at Biarritz, near Bayonne, in the Bay of Biscay, 2d Oct. 1828.

SOUTH-EASTERLY CURRENT OFF CHANNEL SOUNDINGS.—In August, 1826, Captain Livingston, in the *Jane*, between latitude $48^{\circ} 53'$, longitude $16^{\circ} 7'$, and Cape Clear, had a set of $1^{\circ} 14'$ S. and $1^{\circ} 54'$ E. So that, in four days the vessel was set, by a counter current, 74 miles S. and 65 E. or nearly S. 41° E. about 99 miles; equal to a daily average of $24\frac{1}{4}$ miles.

TOWARD the BAY of BISCAY.—The ship *Carshalton Park*, Captain J. Steele Park, on returning from Jamaica to London, in July, 1824, in latitude 48° , and longitude 13° , got into a stream setting to the southward, and which thence operated so strongly against the ship, that some difficulty was found in getting sufficiently far to the northward for a good Channel track. The wind shifted suddenly from S.W. to North; the vessel immediately hauled up E. by S.; and, although the weather was fine, and the water quite smooth, she made no better than a true E. by N. course.

Captain Park says, "the moon happened to be near the full about this time; and I had opportunities for ascertaining the latitude by her meridian altitude three or four nights in succession before we made the land: therefore I could not be mistaken as to the strength and direction of this current; for the interval between the observations of sun and moon was only 10 or 11 hours; and the greatest attention was paid to the steerage."*

* The same ship, on the 10th of July, was on Channel soundings, the latitude by meridian altitude of the sun, $48^{\circ} 53'$: the longitude, by chronometer and lunar, $9^{\circ} 44'$ and $9^{\circ} 56'$ respectively. "Kept the

Off the COAST of PORTUGAL.—A bottle from the brig *Freeland*, Captain T. Midgley, (from Liverpool to Africa,) in lat. $41^{\circ} 50' N.$, long. $14^{\circ} 23' W.$ 11th of February, 1833; picked up close to the shore, off the Harbour of Vigo, on the 1st of March following; having traversed, in a true E. $\frac{1}{2}$ N. direction, about 80 leagues.

ST. GEORGE'S CHANNEL TO CAPE ST. VINCENT.—On the 14th of August, 1823, Capt. *Livingston*, in the sloop *Favorite*, on his passage from Liverpool to Gibraltar, took his departure from the *Smalls Lighthouse*, and thence he regularly made observations on the Current, &c., so far as adverse weather permitted. On the 23d he had arrived on the parallel of $46^{\circ} 23'$; previously to which the course seems to have been materially affected by the tide, but here the differences amounted to $51' 55''$ southerly, and only $4' 39'' N.$ From lat. $46^{\circ} 23'$, August 23d, to lat. $36^{\circ} 52'$, August 31, the current invariably predominated to the southward, and between these parallels amounted to eighty-nine miles, in the eight days.

At 4 h. 53 m. of August 31, with Cape St. Vincent bearing true North, an excellent meridian altitude of the planet Saturn gave lat. $36^{\circ} 52' 8''$. The total southing to this point gave $2^{\circ} 18'$, and the difference of longitude between dead-reckoning and that by landfall gave $1^{\circ} 42' 7''$ of easting.

In the brig *Friends*, of Glasgow, 24th August, 1820, Capt. *Livingston* states, "The current set us round Cape St. Vincent without our having seen the cape, though we steered courses for the purpose of seeing it, and we were looking out for it when I got a lunar, and ascertained that we were then past it. Immediately after this the sea became smooth, being broken off by the cape."

Between CAPE FINISTERRE and the AZORES, the general drift of the surface of the sea appears to be to the south-eastward; varying, however, to the East and West, and even to the northward, as the winds operate, either one way or the other, more especially during winter, as already noticed.

H. M. S. *Pactolus*, in May, 1816, experienced a current South a little East, at the average rate of 30 miles a day, from the English Channel to St. Michael's.

Captain *Charles Hare* in the brig *Ward*, from New Brunswick, Sept. 1823, with westerly winds, which had prevailed for fourteen days, between latitude $43^{\circ} 40'$ and $45^{\circ} 20'$, long. $22\frac{1}{2}^{\circ}$ to 16° , found the current E.S.E. one mile and a half in the hour.

BETWEEN PORTUGAL and the WESTERN ISLANDS.—Captain *Geo. Cheveley*, June, 1830, latitude 44° to 27° , longitude 11° to 21° , current S.E., three quarters of a mile an hour.

Capt. *W. J. Capes*, on his passage in the *Lady Mackworth*, from England to the West-Indies, in August and Sept. 1823, found the currents as follow: taking the ship's position at noon:—

Aug. 27	Lat. 43°	$38'$	Long. 12°	$40'$	Current easterly.
28	..	42 43	....	12 17,	{ By good chronometric observation, the current had set 30 miles to the eastward.
29	..	43 41	....	12 28,	
30	..	41 42	....	12 28,	{ Current 10 miles E.S.E.
					{ Current 25' easting and 11' southing, by good observation.
31	..	40 3	....	13 23,	Current 9' to the S. and 14' to the E.
Sept. 1	..	38 5	....	14 17,	No current perceptible in the 24 hours.
2	..	35 59	....	15 6,	Current 26 miles to the southward.
3	..	34 8	....	15 55,	Current southerly, 3 or 4 miles.
4	..	33 1	....	16 7,	Porto Santo, distant 4 or 5 leagues.
5	..	32 22	....	16 49,	
6	..	31 16	....	17 26,	Current 7 miles to the southward.
7	..	29 28	....	17 38,	Current 10 miles ditto.
8	..	28 48	....	17 26,	Current 17' S. and 13' E.

the ship E. $\frac{1}{2}$ S. and generally East till 11 h. 51 m. p. m., when, by the moon's meridian altitude, it was found that the latitude was $49^{\circ} 11'$. We had gone, during this interval of 11 h. 51 m., 68 miles by the log, carefully attended to, in smooth water. Now, allowing $2\frac{1}{2}$ points of variation, we ought to have made 26 minutes of northing; whereas, in point of fact, we made 13 only."

Influenced, probably, by the Channel ebb, the current appeared also to have a tendency to the west.

Sept.	9	Lat.	28° 32'	Long.	17° 17',	No observation on current.
	10	..	28	9	.... 18 10,	
	11	..	27	4	.... 19 41,	Current, 16' to the southward.
	12	..	25	45	.... 21 43,	Current, 15' to ditto.
	13	..	24	44	.... 23 52,	Current, 4' to the S. and 13' W.

8th April, 1823. Capt. *Hamlin*, in the ship *George IV.* on the passage from Greenock to St. Thomas's, found that they were much to the southward of dead reckoning on several days, and during the last 24 hours not less than 45 miles. Lat. at noon, $38^{\circ} 50'$, long. 19° , or more than 300 miles E. by N. true from St. Michael's.

In September and October, 1775, the officers of the *Liverpool*, ship of war, observed, that, in latitude $45^{\circ} 43'$, longitude $21^{\circ} 20'$, a current was found setting to the southward 12 to 15 miles per day, which continued until they made the island of Corvo, the longitude of which, by lunars, agreed within 12 miles of the longitude by account.

Again, on the 18th of October, in latitude $42^{\circ} 4'$, and the Isle of Corvo bearing about S. 75° E. 154 leagues, the sea being very smooth, it was suddenly agitated into a short irregular sea, (without any shift or increase of wind,) such as is generally occasioned by currents, and the next day it was found that the ship was 30 miles to the southward of the reckoning. This current (*blending with the Gulf Stream*) continued until the 22d of October, having then arrived in latitude 37° , longitude $44^{\circ} 43'$ West of Greenwich, and its general rate appeared to be a mile and a half in the hour.*

The CURRENT along the COAST of PORTUGAL appears to set nearly in the direction of that coast. On the 25th of October, 1810, a gun-boat for the service of Cadiz, being in tow of the *Rebuff* gun-brig, broke adrift in a gale of wind, in latitude $39^{\circ} 44'$, and longitude $9^{\circ} 38'$ W. On the 19th of November following, his Majesty's sloop of war *Columbine*, when cruising 8 or 9 miles to the westward of Cadiz lighthouse, observed a gun-boat to leeward, which proved to be the identical boat that twenty-five days before had broken adrift from the *Rebuff*. The distance traversed by the boat was about 350 miles, or 14 miles a day, chiefly by the current, the wind in the mean time being so various as nearly to render the drift negative, or, if any thing, against the set of the current.

On the currents setting toward the Bay of Biscay and the Strait of Gibraltar, Captain, afterward Admiral, *Sir Erasmus Gower* made observations in five passages to Madeira, from which he concluded the most general direction to be to the S.E., and the mean velocity about 11 miles in every 50 leagues.

Mr. Robert Bishop observed, by experiment, in the year 1761, a current setting on this part of the ocean, between S.E. and South. After making some necessary corrections, he considered the current as setting at the rate of 8 or 10 miles in 100, in a middle rate of sailing. Other experiments have likewise been made, which give nearly the same result; and the observations of Captain Wm. Bligh, of his Majesty's ship *Director*, outward-bound, in September and October, 1799, and made in this part of the Atlantic, are corroborative of the truth of these observations. They shew, that, although the currents in those months are

* The effect of a current setting to the south-eastward, and the necessity of a competent knowledge of currents in general, cannot any way be more forcibly shown than by noticing the melancholy catastrophe of His Majesty's ship *Apollo*, Captain J. W. T. Dixon, and the merchant ships under her convoy, on the 2d of April, 1804. The *Apollo*, with 69 ships, for the West-Indies, sailed from the Cove of Cork on the 26th March. With a fair wind, blowing strong, they steered about W.S.W. until the 31st, when the wind changed more to the westward. At noon, on the 1st April, latitude observed $40^{\circ} 51'$ N., longitude, by account, $12^{\circ} 29'$. At 8 p.m. the wind shifted to S.W., and increased to a gale, with a heavy sea. The convoy stood to the S.S.E., and, at half-past three next morning, struck on the coast of Portugal, in about $40^{\circ} 22'$ N., 3 leagues to the northward of Cape Mondego. Captain Dixon, and about sixty men of the *Apollo*, perished, in their endeavours to reach the shore; the other part of the crew remained two days clinging to a fixed part of the wreck, without nourishment. About 40 sail of merchant-men were wrecked about the same time; some sunk with all their crews, and most of them lost several men. This lamentable event has been attributed to the want of chronometric observations, and the consequent ignorance of the set of the current, which must certainly have been very strong.

"The immediate cause of the loss of so many of the *Apollo's* convoy appears to have been the blind confidence with which the commanders followed their commodore; either keeping no reckoning themselves, or believing his more accurate than their own. Several ships were saved by leaving the convoy; and it is said that the commander of a Clyde ship warned the commodore of his danger in time to have avoided it."—*A. L.*

very variable, but setting mostly in a southerly direction, yet that between South and S.E. predominates.

In proceeding to *Tenerife*, Sir Erasmus Gower observed a constant current setting to the southward, at the rate of a mile an hour; equal to 22 miles in the distance between Madeira and that island.

Captain Mackintosh, of the *Hindustan*, who had made twenty passages in this route, generally experienced a current from the 39th degree of latitude to that of the Canaries. In this part of the ocean he generally found, from repeated and accurate observations, that this current set to the E.S.E. He found it strongest opposite to the entrance into the Mediterranean or Strait of Gibraltar; and, in one voyage, the current was computed, by his time-keeper, to set about 40 miles per day. This current inclines more southerly, as it approaches the Canaries. It strikes on the coast of Morocco, and takes about Cape Boiador a different direction. Nearly in-shore, from an indefinite point, one part of the stream sets northward toward the Strait of Gibraltar, and the other part sets to the southward.

M. le Baron Roussin, in the corvette *Bayadere*, bound from Rochefort to Brasil, in February 1819, after passing Cape Finisterre, found the prevailing Winds from noon to noon and Currents as follow:—

	Latitude.		Longitude.		Winds.		Current.	
Feb. 22 ..	42°	43' 38"	..	11° 40' 6"	..	N.—W.N.W.	..	S.S.E. 24 miles.
23 ..	40	3 28	..	13 44 17	..	N.—N.E.	..	S.S.E. 12 —
24 ..	37	3 49	..	13 35 30	..	N.E.	..	S.S.E. 12 —
25 ..	34	13 12	..	14 10 30	..	N.E.—S.E.	..	S.E. 6 —
26 ..	31	9 17	..	15 24 40	..	N. and N.E.	..	S. 10° E. 12 —

But on arriving at the Canaries, with the wind N. and N.E., the current had changed.

On the course of the same vessel, from Brest toward Brasil, in October, 1821, the current had set on the last 24 hours (Oct. 6) lat. 40° 24' 36" long. 14° 29' 30", S. 15° E. 20 miles: on the three following days, nearly in the same direction, but with less than half the strength. In lat. 35° 20' 50", long. 12° 54' 40", 15 miles S.E. In lat. 33° 54', long. 12° 48' it had set only 6 miles S. 5° E.; but, on the next day, in 34° 18' 24" N. and 12° 21' W., 25 miles S. 25° E.; and again in 34° 14' 34" and 12° 13', South, 20 miles. Off the African coast, lat. 32° 56' 20", long. 13° 16' 20", it had set 32 miles to the S.W., or in a direction nearly parallel with the shore.

At about 74 leagues W. $\frac{1}{2}$ S. from Cape Mondego, on the 9th June, 1799, M. de Humboldt, in the sloop *Pizarro*, was on his voyage toward the West-Indies; and, on this day, in latitude 39° 50' and longitude 13° 50', he says, that they began to feel the effects of the current setting toward the Strait of Gibraltar, &c. From the parallel of 37° to that of 30°, the vessel was sometimes carried, in twenty-four hours, from 18 to 26 miles to the eastward. The direction of the current was, at first, E. by S.; but nearer the Strait it became due East, and it assumed a more southerly direction on the passage toward *Tenerife*. "Several pilots, who frequent the Canary Islands, have found themselves on the Coast of Lanzarote, when they expected to make good their landing on *Tenerife*." M. de Bougainville, in his passage from Cape Finisterre to the Canary Islands, found himself in sight of Ferro, four degrees more to the eastward than his reckoning indicated.

In July, 1816, Capt. And. Livingston, in a run of only nine days from Ireland, during which there was no opportunity for observations for longitude, was set upward of three degrees to the eastward of his reckoning; having made the Salvages, when he expected to have been to the westward of Madeira.*

The frigates *Sta. Maria de la Cabeza* and *Lucia* sailed from Cadiz, 12th April, 1795, and on the 17th at 6 a. m. they made Point Naga, in *Tenerife*, when they found, by a comparison with their chronometers, that the current had carried them 62 minutes to the eastward.

* In late years, and since I read Mr. Bain's book on the compass, I am inclined to think that much of our error in the *Agnes* arose from the attraction of iron near her binnacle. In this vessel we had unaccountable inaccurate reckonings until I pulled her binnacle down at Kingston, Jamaica, when we found two half-inch iron bolts and ten iron spikes in the coamings near the compass. After that our reckonings were as accurate as I have seen those by account in any other vessel.—A. L.

Don Vincente Tofino had, ten years before, proceeded in the *Lucia*, from Cadiz for Mogodor; he sailed on the 27th of April, 1785, and, on the 1st of May, before mid-day, arrived at the last-named port. On the 5th he sailed from it, and on the morning of the 8th anchored again in Cadiz. On his voyage out, he found that the current, in 4 days, had set him $21\frac{1}{2}$ miles S. 18° E., and on his return S. 49° W. 39 miles. This variation of the current shows that the waters throughout all this extent do not always run to the S.E., but that they vary, with the line of coast, to the south-westward also.

The deceased Admiral *Don Cosmè de Churruca* sailed from Cadiz, on the 15th of June, 1792, for the purpose of surveying the West Indian Islands and Spanish Main. He took his *departure* at half-past 3, *p. m.*, in lat. $36^{\circ} 29' 25''$, and long. $0^{\circ} 6' 40''$ W. of Cadiz. In his Journal, he says, "It is well known among our seamen, that, in the light of Cadiz (that is, the coast comprehended between Cape St. Mary and Cape Trafalgar) there is a current setting constantly to the eastward; but as, near the shore, the effect of the tide must necessarily be felt, it may also modify the direction of the current. When we established our point of departure, the strength of the ebb was already begun to decrease; but as, during the early part of the night, we were unable to get any considerable distance from the shore, we consequently felt all the force of the flood-tide setting to the northward; and this appears to have been the reason why we experienced a current to the N.E.: for the current, which commonly sets into the Strait of Gibraltar, combined with the flood-tide, ought nearly to give that N.E. direction. After our *departure*, and from mid-day of the 16th, we sailed with variable winds until the 21st, when the wind became fixed at N.N.E., and we found that, in the 24 hours, from the 21st to the 22d, the current had set S. 42° E. $9\frac{1}{2}$ miles; though in consequence of uncertainty in the dead-reckoning, and the variableness of the wind, it is possible the error was contracted without any current; the situation at mid-day of the 22d being in lat. $30^{\circ} 18' 51''$ N., and long. $8^{\circ} 59' 21''$ West of Cadiz."* The intention was to ascertain the position of the Salvages, which were seen the same evening, and he then makes the following reflections:—"The whole error of longitude by dead-reckoning, was $34' 6''$ E.; the sum of all the errors in latitude, after various compensations, was about $3' 45''$ to the North; therefore, the total error made during the voyage was $34' 6''$ to the eastward, and $3' 45''$ to the southward; and as if we had experienced a daily set of 4 miles S. $82^{\circ} 35'$ E. The Pilot's reckoning was kept by a log-line, marked to 48 English feet, for the 30s. glass, and was a-head of the vessel $57' 25''$ in longitude, and the sum of its errors in latitude was $8' 39''$ to the southward. According to this line, the vessel's total error was about $47\frac{8}{10}$ miles, or 7 miles daily, N. $79^{\circ} 45'$ E. We see, therefore, that the knot of $50\frac{3}{4}$ English feet, indicated better the true course of the vessel until she made the Salvages, as situated by M. Verdun; and that, if it had any fault, it was that of giving too much distance and not too little, as is commonly believed. This experiment, though not, however, sufficient to decide in favour of marking the log-line to $50\frac{3}{4}$ English feet, at least affords a presumptive proof in its favour," &c.†

H.M.S. *Pique* was once set to the S.E., 98 miles in five days, between Cape Finisterre and Madeira.‡

Mr. James Grey Jackson, in his valuable Account of the Empire of Marocco,§ has stated, that, the coast, between the latitudes of 20 and 32 degrees North, is a desert country, interspersed with immense hills of loose sand, which are, from time to time, driven by the wind into various forms, and so impregnate the air with sand, for many miles out to sea, as to give the atmosphere an appearance of hazy weather: navigators, not aware of this circumstance, never suspect, during such appearances, that they are near land, until they discover the breakers on the coast, which is, in some parts, so extremely flat, that a person may walk a mile into the sea without being over the knees; so that ships strike when at a considerable distance from the beach: added to this, there is a current, which sets in from the west toward Africa, with inconceivable force and rapidity, with which the navigator

* From Greenwich, $15^{\circ} 16' 50''$, and about 40 miles to the eastward of the Salvages.—EDITOR.

† Farther remarks on Currents, upon the same voyages, are given hereafter.

‡ H.M.S. *Raleigh*, August, 1826, found the current from off Cape St. Mary, toward the Strait, to set W. 34° S. 26 miles in the 24 hours.

§ London, quarto, 1809. See, also, the affecting Narrative of the Shipwreck and Captivity of M. de Brisson, in 1787; and that of Robert Adams, wrecked in the American ship *Charles*, John Horton, master, 1810. The latter is noticed more particularly, with others, in the description of the coasts of Africa hereafter.

being generally unacquainted, he loses his reckoning, and, in the course of a night, perhaps, when he expects to clear the African coast, in his passage southward, he is alarmed with the appearance of shoal water; and, before he has time to recover himself, finds his ship aground on a desert shore, where neither habitation nor human being is visible. In this state his fears are soon increased by a persuasion that he must either perish in fighting a horde of wild Arabs, or submit to become their captive; for, soon after a ship strikes, some wandering Arabs, strolling from their duar in the desert, perceive the masts from the sand-hills; and, without coming to the shore, repair to their horde, perhaps 30 or 40 miles off, to apprise them of the wreck, when they immediately assemble, arming themselves with daggers, guns, and cudgels. Sometimes two or three days or more elapse before they make their appearance on the coast, where they await the usual alternative of the crew, either delivering themselves up, rather than perish with hunger, or throwing themselves into the sea.

But to resume the description of the currents:—M. de FLEURIEU, in his admirable illustrations of the voyage of *Etienne Marchand*, around the world, has paid very particular attention to the set of the currents throughout the whole of the route, and his remarks corroborate very clearly the facts already described. In that work, M. Fleureau states, that, in a run which he himself made, in 1768-9, in the *Isis* frigate, from Cadiz to Tenerife, by a direct course, and with a steady breeze from N.E. to E.N.E., he had an opportunity of ascertaining the constant effect of the current, which sets to the eastward so long as a ship sails in the tract of sea situated to the westward of the Strait of Gibraltar, and at a little distance from it. Clear weather permitted him, during the four days employed in this run, to take daily observations for determining the longitude of the ship, by the help of the time-keepers of *Ferdinand Berthoud*, of which the daily rate had been ascertained at Cadiz; and, in comparing, every day, the ship's progress toward the west, deduced from the observations, with that indicated by dead reckoning, there appeared the following results:—

On the first day, the current had set to the eastward $11\frac{1}{4}'$; on the second, $12\frac{3}{4}'$; on the third, $9\frac{1}{4}'$; on the fourth, $1'$; when the current ceased, in lat. 31° , to be perceptible.

Therefore, during the first three days, the movement impressed on the ship to the eastward, carried her toward that side $33\frac{1}{2}'$, or $27\frac{3}{4}$ miles; and, by a mean, about 8 miles in 24 hours.

The quantities which the ship had been carried, in the same interval, toward the south or toward the north, had nearly counterbalanced each other: $8\frac{3}{4}'$ to the southward, $6\frac{1}{4}'$ to the northward. (*Voyage de l'Isis, en 1768 et 1769.*)

The ship of M. *Marchand*, named the *Solide*, left Cape Spartel, bearing South, on the 29th of December, 1790, and made the Peak of Tenerife, bearing S. $6\frac{1}{2}^{\circ}$ E., about 35 leagues distant, on the 5th of January, 1791. In this time it was found that a current had set the ship 39 miles E. 13° S., equal to a mean drift of 5.8 miles per day of 24 hours.

From the 5th to the 9th of January, inclusive, when the ship, on the latter day, was in lat. $21^{\circ} 24'$, long. $19^{\circ} 26'$, (from Greenwich,) it was found that the current had set her $50\frac{1}{2}$ miles farther, E. $13\frac{3}{4}^{\circ}$ S., being at a mean rate of $12\frac{3}{8}$ miles in 24 hours.

Between lat. $21^{\circ} 24'$, long. $19^{\circ} 26'$, (as above,) and the Isle of Mayo, during an interval of five days, the ship was carried, by the current, $35\frac{1}{2}$ miles W. $30\frac{3}{4}^{\circ}$ S., or at the mean rate of 7.1 miles in 24 hours.

The *Solide* sailed, on the 18th of January, from Port Praya, St. Iago, on her progress toward Cape Horn; and, although no observation of longitude could be taken, it subsequently appeared, by observations of latitude, compared with the reckoning, that, in the interval from the 28th to the 31st of January, the ship was carried to the northward 50 minutes beyond the run by account; that is, at the rate of $16\frac{1}{2}$ miles in 24 hours.*

As no observations were made for the longitude since the time of departure from La Praya, it cannot be known whether the current, which set to the northward, set at the same time to the eastward or westward: it may be presumed, that its direction was rather toward the latter; because the observations which were made on the 6th of February following, in lat. $5^{\circ} 38'$ S. and $25^{\circ} 38'$ W., indicated, that, in the interval from the 18th of January to the latter day, the ship's progress toward the West, had been greater, by about 21 leagues, than that which was deduced from the dead reckoning.

* This must have been by the Equatorial Current.—ED.

In July, 1792, the *Solide* returned, to the westward and northward of the Azores; and, on the parallel of $41^{\circ} 42'$, at the distance of about 2 degrees North of Corvo, she had a set in one day of 9 miles S. 29° E. Proceeding thence toward Lisbon, she appeared to have a set, in three days, of 27 miles W. 19° S., equal to $9'$ per day in that direction; but, in the following six days, from the N.E. of the Azores to Cape St. Vincent, the current set 74 miles E. $25\frac{1}{2}^{\circ}$ S., equal to $12\frac{1}{3}$ per day: and, between Cape St. Vincent and Cape Spartel, in 42 hours, she found an indraught of 30 miles East, equal to $17\frac{1}{2}'$ per day, setting toward the Strait of Gibraltar.

AFRICA.—The ship *MONTEZUMA*, of Liverpool, Knubley, master, sailed on the 26th of Oct. 1810, for Brasil, but was wrecked on the 23d of the next month, at 3 a.m., on the African coast, somewhere between Capes Noon and Boiador. Among the crew, who were taken and sold by the Arabs, was Alexander Scott, an apprentice; this person was detained in the country for nearly six years; and a very interesting account of his captivity, drawn up by Dr. Traill, with geographical observations on his routes, and remarks on the currents which produced the catastrophe, by Major Rennell, were given in the fourth volume of the Edinburgh Philosophical Journal. The latter are as follow:—

MAJOR RENNELL'S *Remarks on the CURRENTS between Cape Finisterre and the CANARY ISLANDS.*

“I should consider myself highly culpable, if I neglected to state, by way of caution to navigators, the result of my inquiries respecting the currents which appear to have caused the shipwreck of the *Montezuma*, and of a great number of other ships of our own and other nations on the western coast of Barbary; having examined a multitude of journals of ships that have sailed in that track, with time-keepers on board, and which have also, when opportunities presented themselves, had their rate checked by celestial observations.

“The general result is, that navigators, who depart from the parallel of the southern part of the Bay of Biscay, (or say 45°), and sail in the usual track southward, will be assailed, first by a S.E. current, and then by an *easterly* one, until they have passed the parallel of Cape Finisterre; when the current will again turn to the *south of east*, and gradually become a S.E. current, till, having passed Cape St. Vincent, it becomes easterly again; owing, no doubt, to the indraught of the Strait of Gibraltar; and this easterly current is pretty general across the mouth of the bay, between Cape St. Vincent and Cape Cantin.

“Beyond this bay (which may be termed the *funnel*, of which the Strait itself is the *spout*), the current again becomes S.E. or rather more southerly, (as it is more easterly toward Cape Finisterre,) and continues as far as the parallel of 25° , and is, moreover, felt beyond Madeira westward; that is, at least 130 leagues from the coast of Africa; beyond which a S.W. current takes place, owing, doubtless, to the operation of the N.E. trade-wind.

“The rate of motion of this current varies very considerably at different times; that is, from twelve to twenty or more miles in the twenty-four hours. I consider sixteen as rather below the mean rate. I have one example of 140 miles in eight days, in one of His Majesty's ships; equal to $17\frac{1}{2}$ miles per day: and, in another, of only twelve. And in a very well-kept East India ship's journal, 170 in nine days to Madeira, or nineteen per day. The direction of the stream likewise varies, but commonly more toward the *south* than the east, after passing the mouth of the Strait.

“Near the coasts of Spain and Portugal, commonly called the Wall, the current is always very much southerly, owing, perhaps, to the falling in, obliquely on the shore, of the great mass of water brought by the S.E. current; which can run off only toward the south, and round Cape St. Vincent toward the Strait's mouth. And amongst the Canary Islands, and between them and the Coast of Barbary, the currents are less regular.

“It may be taken for granted that the whole surface of that part of the Atlantic Ocean, from the parallel of 30° to 45° , at least, and to 100 or 130 leagues off shore, is in motion toward the mouth of the Strait of Gibraltar.

“According to what has been said, in the course of the above remarks, it must be expected that a ship sailing in the usual track to Madeira or the Canaries, will be carried to the *south-eastward*, at the rate of sixteen miles *per* day; that is, even if she has a fair wind, she will be carried by the current 150 or 160 miles to the south-eastward, in the course of her voyage to Madeira or the Canaries; and, consequently, on a S.E. *by* S. course will be carried eighty or ninety to the eastward of her intended port. If we suppose a S.E. course,

course, the error in easting will be no less than 109 ; which distance, if they are bound to Tenerife, would carry them to Allegranza or Fortaventura ; and, if intending to make Allegranza, would place them on shore on the coast of Barbary. The French and Spaniards report that their ships have often made Allegranza when they supposed themselves on the line toward Tenerife. It must be added that, if a ship had a long passage, the error would be greater in proportion, and might possibly amount to 200 miles of easting.

“ It would seem advisable, therefore, that every ship going to the Canaries, or intending to sail between those islands and the main land of Africa, and being without time-keepers, as that class of merchant-ships commonly are, should, to every day’s reckoning, *add ten miles of easting*. This would, in the first instance, prevent them from *deceiving themselves* as they went forward ; in like manner, as it is better to set a clock forward at once, than to charge one’s memory continually with its being too slow. *Ten miles* does not seem too much as a cautionary measure, as a ship has very lately been carried ninety-nine miles to the *east* in eight days in that track. What would not have been the error had she had even a moderately long passage ?

“ It is this current which has furnished the roving Arabs of the Desert with their victims from every nation, and the good Mr. Willshire* with objects of benevolence.”—27th Feb. 1819.

The *Eliza*, commanded by John Searchwell, sailed from Cork for Rio Janeiro, with settlers, on the 12th of August, 1827, and ran a-shore on the coast of Africa, during a fog, on the 25th of the same month. Whilst making signals of distress, three fishing-boats, from Canary, came to her assistance, and succeeded in saving all the lives on board, consisting of 18 mariners, 244 men, 46 women, and 41 children ; in all 350 persons, who arrived at Canary on the 3d of September.

About the end of October, in the same year, the *Olymphe*, from Havre for Buenos-Ayres, with colonists, was cast away on the same part of the African coast. The passengers, about 300 in number, consisting of French, English, Germans, and Swiss, were taken from the shore, saved from captivity by Canarian fishing-boats, and conveyed to the Grand Canary, where they were landed on the 7th day of November. Such have been, even within a few years, the effects of the current !

The preceding description of the currents between the English Channel and Canary Islands was corroborated in 1836, by Capt. R. H. Newby, in the *Napoleon* schooner, which left Dartmouth, on the 21st of July, and was set to the eastward of reckoning, while crossing the Bay of Biscay, $1^{\circ} 21'$ of longitude in 48 hours. On Monday, the 25th of the same month, the entrance of Ribadeo bore S.W. by compass, about 15 miles, and the vessel was then in about $6^{\circ} 55'$ W.

The effect of the easterly current was proved by the bearings of a remarkable mountain inland, and some whitish cliffs on the shore ; and Captain Newby says, the schooner was setting to the eastward quite as fast as I have noticed a ship to lose ground to the eastward while standing in shore off Beachy Head during a strong flood tide and moderate westerly breeze. At about 5 *p.m.* the wind veered to the N.E., and even then, although the vessel was going at the rate of $3\frac{1}{2}$ knots through the water, she made very little way to the westward till toward sun-down, when the breeze freshened to 7 or 8 knots.

During the night passed Cape Ortegal, and the next morning, at 6 *a.m.* the light-tower at the entrance of Corunna bore south.

It did not appear that the current relaxed in strength between the time of observing the inland objects, and that when the wind freshened. Mr. N. adds that this is the third time he has experienced its effect, without ever perceiving it to set at all to the westward. The last time previous was on the 9th and 10th of September, 1835.

At 3 *p.m.* July 27, 1836, Cape Finisterre bore E.S.E. by compass [*true East*] distant about 12 miles. A fresh breeze from E.N.E. prevailed up to the following noon, when the current had set to the southward about 14 miles, as frequently found on the Portuguese coast at this season of the year. (*See page 171.*)

July 28 to August 1, inclusive, variable weather and north-easterly winds to lat. $29^{\circ} 15'$, long., by account, $19^{\circ} 52'$ W. On the 1st of August it was found that the schooner had

* William Willshire, Esq., the English Consul at Mogodor, to whose active goodness Scott and many others owe their deliverance from slavery.—EDIT.

missed Madeira in her attempt to make and pass the west end of that island, and at 1 p.m. the dark bold northern end of Palma came in sight from under a dispersing cloud, and bearing, by compass, about W.S.W. distant seven leagues.

Upon going over the last two days' works, it appeared that, instead of passing, as supposed, to the westward of Madeira, the Napoleon was actually without a sight of the island to the eastward, and had the vessel been involved in fog, or have been bound to Lanzarote or Fortaventura, and steering, by reckoning, a fair course for them, the consequence must have been that she would have fallen into broken water, when least expected, or have grounded on the main shore, somewhere between Cape Ghir and Cape Noon, and property, if not life, would have been lost. It is, moreover, to be observed that the sea had been, for the most part, comparatively smooth; had there been a strong N.W. swell, such as is commonly felt toward the mouth of the Strait of Gibraltar, then the vessel must have been set still farther to the eastward of her reckoning.

After making the north end of Palma, the breeze continuing rather light at N.E., the vessel hauled on a W.N.W. course, in order to get to the westward of the island, and so as to avoid the risk of getting into the calms or eddy winds to leeward of it: but up to sunset she made very slow progress westward; the swell was short and cross from the northward, and there appeared to be a strong current from the N.W. toward the island, and the captain found it necessary to steer N.W., but still the vessel was found to be approaching the north side of the island. At 9 p.m. he began to be alarmed at his proximity to land; braced up the yards and trimmed sails by the wind, but the breeze died away so light, and the swell kept up so cross, that at 10 h. it was thought the vessel must be driven upon the island, unless a spot could be found for the anchor to take hold of; but, in about half an hour after, it was found that they had gained a different stream of current, and the vessel was visibly set from a S.S.E. to a S.W., or to the westward of a S.W. direction; and, after passing a headland which appeared in the night to be the N.W. part of the island, and sloping toward the sea, the breeze again freshened, and the vessel increased her distance from the black and inaccessible looking shore of Palma.

Captain Fitz-roy, in H.M.S. *Beagle*, January, 1832, states that, on proceeding southward, "During the whole of the 7th, the Peak of Tenerife was visible; but on the following day no land was in sight, and the ship made rapid progress. A very long swell from the N.W., which was felt until the 10th, was probably caused by a gale in the northern Atlantic; and, judging from its size and velocity, I should think that it could not have subsided before traversing many, perhaps ten, more degrees of latitude; which would be to about 10° N. It is interesting to notice how far the undulatory movement of water reaches; in this case it extended through at least ten degrees of latitude, where the wind was from different quarters, and probably much farther." (*Vol. II. p. 49.*)

Jan. 15.—"In consequence of a thick haze, very prevalent about the Cape Verde Islands, land was not distinctly seen until we were within three miles of it, and we then found ourselves rather too far westward, owing to a current setting toward the west, at the rate of two knots an hour; this was close to the north point of St. Iago. Next day we anchored in Port Praya."

The BARON ROUSSIN'S Remarks on the CURRENTS between Cape Bojador and the Isles de Los.

The general currents on the African Coast, between Cape Bojador and the Isles de Los, with the exception of some places subject to a more or less regular tide, are uniform during the eight months which comprise the fine season. They follow exactly the trend of the coast from north to south.

From Cape Bojador to the Bay of St. Cyprian (lat. 22° 20') they therefore set to the S.S.W., from that bay to Cape Blanco; and along the whole extent of the bank of Arguin to its western point, which is in the parallel of 20° 6' 20" N., they set S. by W. To the southward of this point the waters, being no longer guided by the edge of the bank, which turns abruptly to the S.E., do not follow in a body, within a certain space, any fixed or determined direction. One part of their mass experiences a number of irregular windings, until finding itself in the active body of the general current, which left the bank at its most salient point, rejoins it, and is carried on as before.

In the vicinity of Tanit Bay, in the parallel of 19° 10' N., it again resumes its former direction, and follows the trend of the coast, thus setting to the southward as far as the two

Palms, near Portandik, and from thence S.S.W. to the Marigot of Musquitoes. It then sets S. $\frac{1}{2}$ W., till abreast of the bar of the Senegal, where, in a space of four leagues in circumference, it is disturbed by the stream of that river. This stream is so strong as to oblige vessels at the anchorage off the bar to tend to it, in spite of the strongest winds. The current, joined by the waters of the Senegal, pursues its course along the coast, which trends to the S.W., observing a very gentle curve, which forms the Bay of Yof, and which terminates at Cape Verde. The strong currents hitherto pretended to set into the Bay of Yof, are therefore merely chimerical, and the depth given to this bay in all the charts is no less so. Cape Verde being the most western point of Africa, and hence forming an obstruction to the general direction of the waters which flow along that coast, must occasion a great variety of currents in its vicinity. It is, in fact, what takes place, and it would therefore be difficult to define a particular one. This only appears certain: vessels passing in sight of Cape Verde are not carried on it, as is generally supposed; but, on the contrary, they are swept off by the prevailing tendency which the waters have to flow to seaward. In running close to the Almadie Rocks, this repulsion is sensibly felt during the eight months which I have mentioned: it appears that the current rushes between these rocks, and spreads itself in different directions.

Immediately to the southward of Cape Verde, the current is almost imperceptible, and it is scarcely possible to assign any particular direction to it as far as Cape Naze. The whole of the coast, lying between this cape and Cape Manuel, forms a well-defined bay, totally free from current, and in which there is not a single river. The same is observed with respect to the roadstead of Goree, although, according to the observations of Mr. Adanson, a regular tide exists there, with a rise and fall of two feet six inches. In the offing of Cape Verde, the current has been always found to set to the southward. From Cape Naze it again follows the direction of the coast, interrupted only at the mouths of the principal rivers which lie between this cape and Cape Roxo. From this point, localities of a very different nature produce particular effects in the current. The Archipelago of the Bissagos here succeeds the straight coast which extends to the northward. Large rivers empty themselves amongst these islands, forming various channels, more or less encumbered with sandbanks. These obstacles cause a variety of currents, which will be explained when treating on the Bissagos.

Strength of the General Current.—The rate of the general current on the African coast, deduced from numerous observations, has never exceeded a mile and five-tenths per hour on the coast itself, and on the outer edge of the banks; and more frequently it has been found from seven to nine-tenths of a mile. This is diminished one-third, and frequently one-half, at the distance of four leagues from the coast. Should a vessel have run past her port, there is no fear of her stemming this current, and by long boards easily regaining her destination.

In the rainy season, which is from the commencement of June to the end of October, as the winds blow from various directions, the currents are no longer regular, and it is impossible to establish any positive law respecting them; but, even under these circumstances, their strength is not so great but that it may be surmounted.

3. THE AFRICAN or GUINEA CURRENT; *being an Easterly stream along the coast of AFRICA, into the BIGHTS of BENIN and BIAFRA, with a westerly outset from the same.*

The great current from the N.W., partaking both of *drift* and *stream*, begins to change from S.W. to South immediately after passing the Cape Verde Islands, whence it becomes first southerly, and afterward gradually winds round to the S.E., and finally to E.S.E. and East: but it varies so slowly, that its western border will still be found about the meridian of St. Antonio (25°) in latitude 8° N.; from whence, turning more toward the East, the same border will again be found in about latitude 4° N. and longitude 20° W.

At the distance of about fifty leagues south of Cape Palmas (long. 73° W.) the outer border of the Guinea current sets to the East; and the same direction of it continues to a similar distance south of Cape Three Points (long. 2° W.): we thence, at two degrees North of the Line, find it take a more northerly course, toward the Bight of Benin and the Bight of Biafra: in the latter it mixes with the waters of the *South-African Current*, which, coming from the South, set thence to the North and N.W., and both, uniting, form a head in the Bight. From this Bight and southward of the Equator the currents, thus blended, set to the

the S.W., W.N.W., and N.W., in one expanding and united stream, which greatly facilitates the passage of ships from Fernando Po to Sierra Leon.

The GUINEA CURRENT, therefore, inasmuch as it is a continuation of that off the coast already described, winds round in the offing, and nearly in the direction of the bank off the coast, to the S.E. and East; and under the meridian of 11 degrees west, has been found to set at the rate of 25 miles to the E.S.E. in the 24 hours. Increasing in strength off Cape Palmas, it thence sets to the East and E.N.E., at the rate of 40 miles: off Cape Three Points, and thence to the Bight of Benin, at the rate of from 30 to 15 miles.

The prevalence of the Harmattan wind, which has been described, must interrupt the course of this current; but its existence, at other times, nearly as described, has long been confirmed, and is incontestible. The reader may, however, here refer to the remarks of M. la Pérouse, on crossing the line, page 97.

Near CAPE MOUNT, the current sets in toward the shore.* On the western side of *Cape Palmas* it sets along shore with such force to the S.E., that ships, which do not steer a point nearer than the true course, will be carried from the land. About *Cape Three Points*, likewise, the stream runs strongly to the eastward, and frequently sets directly in upon the reefs about that cape. Eastward of this cape the current has carried many experienced mariners, bound to Cape Coast or Annamaboe, to leeward of those ports, and occasioned much trouble, with delay, in beating up again. About *Terra Formosa*, in July and August, the current has also been found to set strongly to the eastward.

The *Equatorial Current*, which sets from the Bight of Biafra, and then westerly to the southward of the Line, has been illustrated, as already explained, in our '*Directory for the Ethiopic Ocean*,' by Mr. Jas. Finlaison. That gentleman has shown, how, by taking advantage of it, ships may effect, without difficulty, a passage from the Bight to Sierra Leon. His instructions are as follow:

"Ships bound from the Bight of Biafra to Sierra Leon, if from Calabar River, when the wind does not permit them to proceed by the N.W. of Fernando Po, may pass between that island and Camaroens River, when they will find a strong current setting to the southward, out of the River del Rey. After they have advanced to the southward of Fernando Po, they must endeavour to make all the southing and westing they can; passing either to the eastward or northward of Prince's Island, as winds will permit. On the east side of this island, the current sets strongly to the southward, at the rate of a knot and a half: westward of Prince's Island, it generally sets strongly to the N.E., at the same rate.†

"Having arrived to the southward of Prince's Island, if the ship will lie no higher than W.N.W., tack immediately, and try to cross the Line; for, by so doing, you will keep out of the strong N.E. current that sets toward the bights of Benin and Biafra. After you have crossed the Line, you will find that you are nearly out of the easterly current. In the parallel of one degree south, you will find the current set to the westward, at the rate of one mile an hour. In the month of May or June, when the sun has a high declination, the trade-wind is far to the southward, and you will not gain the regular breeze nearer than in

* The ship *Charles*, a French whaler, in 1833, was wrecked on the coast at about thirty leagues to the S.E. of Cape Mesurado; probably on the reefs near the River Sestros. This vessel had left the port of Havre, for the fishery near *Tristan da Cunha*, in the Southern Ocean, but the captain, while intending to run along the coast beyond Cape Palmas, in the hope of falling in with whales, unfortunately lost his reckoning, by being deprived, for 48 hours, of all means of taking observations; and was moving at the estimated rate of seven miles an hour, when he found himself close on shore in the midst of breakers, which, in the course of the night, forced him on the reef and dashed the ship to pieces. The captain and crew got safe to land, but were soon stripped by the blacks, and the captain himself left without covering. In this condition they made their way along the shore to the N.W., until they reached Cape Mesurado, where they were received with all kindness by the colonial agent of *Liberia*, who sent them in a small government schooner to the Isle Goree. The catastrophe is evidently attributable to an easterly current.

† In the last edition of the *Derrotero de las Antillas*, the following remarks are said to have been found among the papers of the deceased Admiral Don Josef Varela. "At Prince's Island, and in its vicinity, the waters generally run to the North, which circumstance ought to be kept in mind in making the island and steering for the anchorage. There are also currents to the south, but they are not so strong, or of so long duration. The pilots of the place say that the currents depend on the phases of the moon, but we found that they were irregular." From this, we may infer, that there is some irregularity in the outset or revolving current; for which, consequently, every precaution should be taken.

three degrees south. This breeze commences from S. by W. As you make westing, the wind will be found to haul more to the southward and eastward, and the current increases to the rate of a knot and a half in an hour, until you arrive as far to the westward as 15 degrees west. On proceeding hence to Sierra Leon, come no farther to the eastward than 15 degrees west, until you are as far to the northward as $8^{\circ} 30' N.$; then you may steer boldly in for the Cape. You will strike soundings in that parallel, in $14^{\circ} 40' W.$; and, as you approach the Cape, the soundings will be found very irregular, from 20 fathoms to 12 at a cast. You will then be 7 leagues from the Cape, and in the fair track of the river.

"Having given these directions to our Prize-master, they generally made the passage from Fernando Po and Bonny in five weeks; merchant-vessels have frequently been three months, by keeping in-shore."

In his Investigation of the Guinea Current, *Major Rennell* says, "I have now brought you to the Cape Verde Islands, by what is called the *Outer Passage*, and which is to be preferred, at all seasons, for ships bound to the southward; because, even when the S.W. monsoon prevails,* between latitude 15° and the Equator, and you are compelled to go to the eastward, (between June and September,) you will be farther to windward, and will have a more steady wind, and favorable current to the S.E., than near the coast of Sierra Leon, &c. But, if you are bound to Sierra Leon, you will, of course, keep a southerly course from the Canary Islands, (Palma and Ferro,) and you will find a favorable current the whole way to that place.

Although you will, at this season, carry a fair wind with you to Sierra Leon, yet it may be proper to inform you that, within the space, lengthwise, between Cape Verde and Cape Mesurado, and in certain places to the extent of seventy leagues off shore, (fifty off Sierra Leon,) a regular change of winds and currents takes place, according to the seasons; that is to say, a N.E. or North wind and S.E. current, from September to June; and, in the rest of the year, S.W. wind and N.E. or northerly currents. In effect, a *monsoon*; and this extends, in respect of the winds, nearly through the whole space between the two continents.

The Current in the offing, in the parallels South of *Cape Roxo*, ($12\frac{1}{2}^{\circ} N.$) continues its course, gradually bending more and more to the south-eastward, till about the latitude of $5^{\circ} N.$ it turns decisively to the East; and running with considerable rapidity, sometimes at the rate of two knots, it ranges along the whole coast of Guinea until it is partly dissipated in the Bight of Benin, &c. The *Guinea Current* may be taken at sixty leagues in breadth; its greatest rapidity is during the season of S.W. winds in the sea lying West of Sierra Leon and South of the Cape Verde Islands.

It has been shown that periodical winds (in other words a *monsoon*) prevail on this coast. It is also known, from the journals of the *Grenville* and *Royal Charlotte*, E.I.M., both of which coasted the western shore of Guinea; that is, between *Cape Verde* and *Cape Mesurado*, a space of about 200 leagues, the former in *June*, the latter in *January*, that, during the former period, (June,) which was that of the *northerly* winds, a current, which might be called the *Inner Current*, ran to the *south-eastward*; but, in the season of *southerly* winds, the contrary, or north-westward: that is, in both cases, the *current* ran to leeward; and also nearly along shore. This inner current then, in the season of northerly winds, is, of course, blended with the eastern border of the great current from the N.W., which has been described as passing along the coast, and occupying a space of three degrees in breadth. But, in the season of southerly winds, the Inner Current runs, in the nature of an eddy, between the South-easterly Current and the shore, from which, it may be concluded, it does not extend far out.

A bottle from the brig *Frecland*, Capt. T. Midgley of Liverpool, in latitude $1^{\circ} 13' S.$ and long. $4^{\circ} 11' W.$ 31st July, 1835; picked up in the surf at Grand Sestros, lat. $4^{\circ} 39' N.$, longitude $8^{\circ} 6' W.$, on the 15th Nov. following; and forwarded to England by Captain Penrice, of the brig *Meg Merrilies*, belonging to the same owner. This was probably

* The term *MONSOON*, or rather *Mousoon*, among the native mariners in the Indian Ocean, is said to mean nothing more than *season*; that is, the vicissitude or changes of season.

By a *partial monsoon* is meant a periodical wind, or stream of air, which does not extend all the way across the sea, as on the coasts of Brasil, Africa, &c.

carried on a circuitous route to the westward by the stream South of the Line, and thence to the North and N.E. by the inshore current.

4. The CENTRAL DRIFT CURRENT, between the AZORES and BERMUDAS, &c.

The Easterly and South-easterly Currents, which have been described in our preceding pages, do not prevail to the S.W. of the Azores. On the contrary, to the W.S.W. and S.W. of those islands, the Currents appear to fall into the *Sargasso Sea*; and to the southward of the Tropic, far to the west, they blend with the *Equatorial Current*, which sets from E.S.E. to W.N.W. and West. Toward the west, they occasionally extend to the northward of the Bermudas; and, even unite with the southern edge or *reflow* of the Gulf-Stream. The recent examples of them which we have to adduce are not numerous, but they are satisfactory; they also accord with natural facts, and are in unison with that theory which derives its currents from the rotatory movement of the earth and the operation of the Trade-winds.

SARGASSO SEA.—Having mentioned the *Sargasso Sea*, it here becomes proper to notice, that the portion of the ocean bearing this name is that central portion distinguished by the weed called *fucus natans*, or floating weed. The name was imparted by the early Portuguese navigators, who called it *Sargaçao* or *Sargasso*, from the form of the seed-pods, or fruit of the plant, which have been called tropical *grapes*. It is described in its proper place, in a subsequent part of this work, but requires a general notice here, in its relation to the Currents.

The *fucus natans*, by our sailors called *Gulf-weed*, occupies a vast space between the parallels of 37° and 18° N., and between the meridians of 33° and 43° W. This space is commonly studded over, like an inundated meadow, with the bushes, which are in some places very abundant, and in others more dispersed. "If we could imagine the surface of a wide extended moor, covered with water, the furze and heath-bushes would appear something like the clusters of *fucus* scattered over the thickest part of this sea."

The Sea of Sargasso may be considered as an eddy, situate, in point of latitude, between the regular Equinoctial Current on the south, setting to the westward; the South-easterly Current from the Northern Sea, on the East; and, as the recipient of the Gulf-Stream from the North and N.W. The tract which it occupies is more than 1200 miles in length from north to south, and within these limits the weed appears in greater quantities than elsewhere; and it does not appear to have varied its position, in any great degree, during the last fifty years. Hence it appears to have been stationary for ages; perhaps from the time of Colombo or Columbus, by whom it was first noticed.

Major Rennell has noticed that the breadth of this mass of weeds is small, in proportion to its length; being drawn out into a kind of stream, and bending a little to the east of south. Dr. Franklin crossed it in about latitude $36\frac{1}{2}^{\circ}$, and found it less than fifty miles in breadth, but it spreads to the southward; and, in latitude 20° , appears to have been, at times, 150 miles wide; although, perhaps, consisting only of various parallel streams of weed.

"It has been observed that the waters of the Atlantic have a greater tendency toward the middle of the ocean than otherwise, and this seems to indicate a reduced level, forming a kind of hollow space or depressed surface. It is certain that the setting of the currents is such as might be expected to take place if such a hollow existed; for the currents do really set into the Sargasso Sea from the north and from the south; whilst in the middle part, although within the region of the trade-wind, the currents are not regular, but indicate a kind of vortex."*

From the great central mass, portions of the weed appear to be carried by the drift to the S.W. toward the Virgin Isles, Porto-rico, &c., until they fall into the great Equatorial Current; and we have the authority of an officer for stating that, on a voyage to the West-Indies, in May, 1833, after passing far to the southward of the Canaries, a first patch or field of weed was found on the 26th of May, in latitude 20° , and long. 49° ; the weed was afterward found in latitude $18\frac{1}{2}^{\circ}$, and continually observed from this time to the close of the voyage to New Providence, increasing in quantity on approaching the Virgin Islands, but in

* Rennell's 'Investigation,' page 72.

detached pieces. The greatest quantity was found on the 28th of May, in $19^{\circ} 15' N.$ and $53^{\circ} 44' W.$, and on the 6th of June, in $21^{\circ} 50' N.$ and $68^{\circ} 11' W.$ Large compact fields were not met with until the return of the vessel in passing the latitude of 20 degrees $N.$

Captain Bourke, in the brig *Archibald*, December, 1815, found large quantities of the weed near the parallel of 20° , to the northward of the island Porto-rico, and of the eastern part of Hayti: but on his passage through the Bahama Channel, eastward of the meridian of 70° , and on the north sides of Hayti and Cuba, none of the weed was seen. This may be accounted for on the supposition that it was drifted by the current from the great bed of weed to the N.E. as explained above.

Among the communications which we have received from Lieut. Jn. Evans, R.N., is the following. "In November, 1810, H.M.S. *Belvedere*, in the centre of the Atlantic, latitude $33^{\circ} 20'$, long. $41^{\circ} 37'$, passed through prodigious quantities of *fucus natans*, in line north and south, as far as the eye could see; and notwithstanding that there prevailed a very heavy swell, from the north, their position was not altered. The quantity of this weed met with between the 30th and 36th degrees of latitude is really astonishing; at times you may sail for leagues through it, covering, as a mantle, the surface of the sea: I have often seen it in lines about 300 or 400 fathoms in length, (sometimes only a few yards,) and frequently in large and small patches of irregular shape, but generally in a circular form. The deep sea-line should be put over the side frequently in this particular part of the Atlantic."

In the year 1825, the brig *Erin*, from the Pacific Ocean to Liverpool, when to the westward of the Azores, passed compact parallels of *fucus natans* in lat. $39^{\circ} 59'$, long. $33^{\circ} 46'$. The weed was less broken than any they had before seen; the nodules large and of a deep yellow brown colour, and the lines extending as far as the eye could reach, in a direction about S. by E., being nearly at right angles with the vessel's line, which was E. by N. The wind was S.E. by S., strong gales and a heavy sea.

The CURRENT, to which we now revert, is the great DRIFT of the ATLANTIC, under the influence of the N.E. trade-wind, and it reaches, in a S.W. and W.S.W. direction, to the West Indian Islands. Of its operation there scarcely requires a demonstration, but the following are examples.

Captain J. W. Monteath, on his passage from Liverpool to Norfolk, in Virginia, in February, 1816, between the island of Terceira, Azores, and latitude 32° , long. 45° , in a run of eight days, by lunar observations, found the current had set the vessel *three degrees* to the W.S.W. of the reckoning: but from this position, until his arrival in the Florida Stream, little or no current was found.

In 1823, the corvette *Bayadere*, Capt. Roussin, on approaching and passing the Azores, upon her return from Rio Janeiro, Nov. 20 to Nov. 25, found the prevailing Winds and Currents as follow:—

	Latitude.	Longitude.	Winds.	Current.	
Nov. 20.	$36^{\circ} 48' 12''$	$33^{\circ} 24' 50''$	E. by the S. to W.	S. $46^{\circ} W.$ 23 miles.	} CENTRAL CUR- RENT, westward of the Azores.
21.	$37^{\circ} 42' 3''$	$31^{\circ} 16' 15''$	N.N.E. to W.S.W. by the W.	S. $10^{\circ} W.$ 24 —	
22.	$38^{\circ} 13' 56''$	$27^{\circ} 43' 40''$	N.N.W.	S. $8^{\circ} W.$ 24 —	
23.	$39^{\circ} 36' 21''$	$25^{\circ} 3' 15''$	N.N.W.	S. $65^{\circ} E.$ 28 —	} S.E. CURRENT, eastward of the Azores.
24.	$40^{\circ} 16' 0''$	$23^{\circ} 29' 0''$	North	S. $50^{\circ} E.$ 13 —	
25.	$40^{\circ} 25' 50''$	$22^{\circ} 53' 50''$	East	S. $75^{\circ} E.$ 10 —	
26.	$41^{\circ} 48' 50''$	$19^{\circ} 15' 20''$	S.S.W.	S. $70^{\circ} E.$ 11 —	

Here, therefore, the line of distinction was experienced in a very sensible degree.

In June, 1816, H.M.S. *Pactolus* experienced a southerly and south-westerly current of ten miles a day between St. Michael's and lat. 36° , long. $42\frac{1}{2}^{\circ}$. This must have been on the tail of the Gulf-Stream and in the Weedy Sea. The *Pactolus* felt no other current in her way to Bermudas, until she came within 70 miles of those islands, and then had a current of 13 miles a day, W.S.W.

It has been stated by Sir Philip Broke, that, when cruising to the southward and eastward of the Bermudas, in 1811 and 1812, there were strong currents running to the S.W. or W.S.W., and that he spoke with many vessels from the West Indies, Carolina, and Florida, going toward England, which had been driven from 10 to 12 degrees of longitude to the westward of their reckonings: and some which were not advanced 500 miles on their way from Amelia Island (Georgia) were half that distance out in their account of longitude. It was Sir Philip's idea, that, "beyond the southern boundary of the Gulf-Stream,

Stream, from the Azores toward the Bermudas and Bahamas, there is a strong set to the S.W. or W.S.W."

WESTERLY DRIFT to ST. EUSTATIUS.—A bottle from the ship *Wm. Miles*, Captain Jas. Pike, bound to Jamaica, lat. $18^{\circ} 28'$, long. $57^{\circ} 20'$ (date omitted). Picked up on the beach of St. Eustatius, 26th of February, 1839.

CENTRAL DRIFT to the BAHAMAS.—A bottle from the ship *Wellington*, Capt. Liddel, in lat. $17^{\circ} 55'$, long. $39^{\circ} 0'$. Picked up by Capt. Rodberd, of the American brig *Patriot*, on the eastern shore of Abaco, Jan. 1, 1837.

A bottle from the brig *Sir Chas. McCarthy*, of London, Capt. C. M. Field, from Demerary, toward London, 15th Oct. 1824, in lat. $22^{\circ} 0'$, long. $53^{\circ} 30'$, found at the S.E. end of St. Salvador or Cat Island, 29th May, 1825.

CENTRAL DRIFT to CUBA.—A bottle from the ship *Kate*, Capt. F. F. Creswell, in latitude 24° , longitude 19° , on the 27th of June, 1825; found on the coast of Cuba, 30 leagues to leeward of Baracoa, in about lat. 22° , and long. 76° , 28th Nov. 1826.

CENTRAL DRIFT to the CAYCOS.—A bottle from the *Countess Dunmore*, J. H. Robertson, in lat. 27° , long. 28° , 8th March, 1823; found on the shore of the West Caycos, in lat. $21^{\circ} 40'$, long. $72^{\circ} 30'$, 19th May, 1829.

CENTRAL DRIFT to the VIRGIN ISLES.—A bottle from the *Emerald*, Captain Nockells, bound to Jamaica, 17th December, 1831, in lat. $36^{\circ} 40'$, long. per chron., $12^{\circ} 32'$. Found on the north side of Anegada, 8th January, 1833. The winds for the last three days, previous to the 17th of December, were from North and N.W. to S.W. For eight days preceding these it blew a continued and heavy gale from S.W. and W.N.W., the bark lying to the whole time, and drifting from lat. $41^{\circ} 28'$ 237 miles to the northward.

A bottle from the ship *Isabella*, of Leith, 2nd April, 1835, in lat. $23^{\circ} 19' N.$, longitude $37^{\circ} 50' W.$ Having lost the N.E. trade in the morning. Wind then E.S.E. Found by Cooper's Island, near Tortola, 13th September, 1836.

BETWEEN CAPE VERDE ISLES and NORTHERN ANTILLAS.—A bottle from the ship *Mary*, Capt. Abyah Locke, from Otaheite to London, 16th March, 1832, in latitude $14^{\circ} 48' N.$, long. (by chron.) $32^{\circ} 25'$. Found on the eastern side of Barbuda, in the following October.

CENTRAL DRIFT to JAMAICA.—A bottle from the ship *Stratford*, of London, Captain Abyah Locke, in latitude $14^{\circ} 27'$, longitude $34^{\circ} 22'$, January 29th, 1836. Picked up at two miles from land, near Gallina Point, on the N.E. side of Jamaica, 2nd of November, same year.

CENTRAL DRIFT and EQUATORIAL CURRENTS.—A bottle from the ship *Gambia*, in the River Gambia, lat. $13\frac{1}{2}^{\circ} N.$, in the latter part of 1831. Picked up on the southern side of Virgin Gorda, lat. $18^{\circ} 30'$.

CENTRAL DRIFT and EQUATORIAL CURRENTS.—A bottle from the *Two Brothers*, of Baltimore, in latitude $17^{\circ} N.$, longitude $26^{\circ} W.$ (off St. Antonio), 21st November, 1826. Found at Acklin's or South Crooked Island, in lat. $22^{\circ} 12' N.$, long. $74^{\circ} 18'$, on the 8th December, 1827. Hence it appears to have drifted in a W. by N. direction, from the vicinity of the Cape Verde Isles to the West Indies, under the influence of the Drift from the N.E. and the Equatorial Current, probably in the first instance W.S.W. and thence W.N.W.

MADEIRA to the WEST INDIES.—A bottle from the ship *Symmetry*, of Scarborough, Captain Smith, on her way from Leith to Buenos-Ayres, off Madeira, 9th June, 1825. Picked up at Salt Kay, Turk's Islands, after a lapse of ten years, 9th June, 1835.

Capt. W. J. Capes, in the *Lady Mackworth*, (vide page 170,) in September, 1823, from the 14th of that month to the 8th of October, pursued his direct course to Barbadoes, from lat. $24^{\circ} 0'$, long. $25^{\circ} 1'$, his situation at noon on the 14th. He says that, from leaving the island Ferro, we found the current setting us at the rate of from 3 to 5 miles a-day westward, and generally a little southing. The weather was remarkably fine all the way to Barbadoes, and always fair, so that I never took in a royal: the log-glasses well adjusted, as well as the log-line; but, on making Barbadoes, we found the chronometer to be remarkably correct, and that the ship was 112 miles a-head of dead-reckoning.

To the south-westward of Madeira, between the island and lat. $28^{\circ} 0'$, long. $18^{\circ} 24'$, Capt. Livingston found the set to be $14^{\circ} 38' S.$, and $37^{\circ} 51' W.$, 10th and 11th April, 1826.

Proceeding

Proceeding south-westward, from the spot last mentioned, to lat. $14^{\circ} 7'$, long. $44^{\circ} 6'$, in 15 days the sets were $14^{\circ} 40'$ N. $1^{\circ} 11'$ S.; $11^{\circ} 15'$ E. and $2^{\circ} 6'$ W.—Surplus effect, $56^{\circ} 20'$ S. and $1^{\circ} 54'$ W.

7th Dec. 1810.—H.M.S. *Belvedere* sailed from Bermuda, and proceeded toward the Azores. On the 21st (14 days' run to the eastward) lat. observed $36^{\circ} 22'$ N., long. by account, $34^{\circ} 9'$ W., by lunar $35^{\circ} 5'$, by chron. $35^{\circ} 0'$; leaving $51'$ for westerly current.

To the above we shall only add that, on the 25th of November, 1790, the merchant ship *Rosalia* sailed from Cadiz for Vera-Cruz, having, as passengers on board, Don Josef de Espinosa and Don Ciriaco Cevallos, officers of the Spanish navy, who had two good chronometers. This ship made Cape Cabron, on the N.E. side of Hayti, after a voyage of twenty-three days, and it was then found that the currents had carried them *four degrees* to the westward of dead-reckoning; and that, consequently, the daily drift averaged about seven miles.

5. THE EQUATORIAL CURRENT, or CURRENT from the EQUATOR to the COLOMBIAN or CARIBBEAN SEA.

The action of the S.E. trade-wind, in the equatorial regions, and the apparent disposition of the waters in these regions to retire westward, which have been attributed to the rotatory motion of the earth, are considered as the causes of a current which is known to flow, during great part of the year, from the Ethiopic Ocean to the Caribbean Sea, and which has frequently carried ships considerably to the West and W.N.W. of their reckonings, when off the N.E. part of Brasil.

The Current from the Indian Ocean, setting over the Bank of Agulhas, past the Cape of Good Hope, and to the north-westward beyond St. Helena, &c. is here united with the *Equatorial Current*, which thence form one great volume or continued stream.* Of this stream the western border is controlled and variegated by the South-American coast and West Indian waters, while the northern and eastern borders run to the West, North, and N.E.; in the last two directions from the Equator, in about 23° of longitude, toward Cape Verde and the Cape Verde Islands. Beyond the parallel of these islands, a gentle *westerly current* marks the boundary of the Equatorial stream on the east, and commonly pursues its course so as to form a junction with it on the west. The last effect has been noticed in the remarks on the Central Currents above.

It appears, from the description of Anegada, &c. by Mr. Schomburgk, (see Note 5, page 79,) that the northern border of the Equatorial Current, especially *while the sun is advancing northward*, extends itself to the northward of all the Caribbee and Virgin Islands, &c., and winds thence into the Caribbean Sea. It must thus fill, in its way in a N.W. direction, the passages between the Windward Islands; and Mr. S. has shown, from various instances, that many vessels, bound to St. Thomas's and St. Martin's, and supposed to be considerably to the northward of Anegada, have, in consequence, been lost on that island. His actual experiments have also proved that the current off the north side of Anegada set at times to the W.N.W. and N.W. by N. In the waters between Virgin Gorda and Anegada the set at the time was always the same, and the rate about one mile an hour.

On the north side of the isle a great quantity of cork shavings are annually washed on shore. These appear to be brought from the coasts of Spain and Portugal, first by the southerly, and next by the central drift or westerly current, which here *unites with the Equatorial*. The extent of the northern extremity of the latter is unknown, but we conceive that it never exceeds the parallel of 20 degrees, where it probably *brushes* the offsets of the Gulf-Stream, setting easterly from the Bahamas.

The greatest number of wrecks on Anegada have occurred in the months from March to June. Vessels of large burden have usually struck on the reefs to the S.E., and smaller ones farther to the west.†

The fact that the current above described is the Equatorial Current has been corroborated

* For the CAPE CURRENT, as described by Major Rennell, &c., see our Sailing Directory for the Ethiopic or Southern Atlantic Ocean.

† See Journal of the Royal Geographic Society, Vol. II. p. 166.

by the temperature of the water ; for it has been observed that, in the parallel of Barbadoes, and between the meridians of 54° and 57° (a tract of sea peculiarly noticed for its discoloured water) the temperature was from 82° to $83\frac{1}{2}^{\circ}$ in the beginning of November ; which is higher, 2 to $2\frac{1}{2}$ degrees, than on either side. At the same time a considerable current from the S. E. ran through the space which contained the warmer water ; proving that it was from the southward.

With the greatest velocity of the Equatorial Current we cannot pretend to be accurately acquainted. Its general direction, when in full force, in the lower parallels, is W. N. W., and generally, it is imagined, about one mile and a half in the hour, but increasing to the westward ; so that off the coast of Guyana it commonly sets at the rate of two or three miles.

Near the parallel of 15° N. the Currents produced by the N. E. and S. E. trade-winds may be imagined to unite ; and this united stream, being divided by the Antillas, thence passes into the Caribbean Sea.

From the mouths of the Marañon, Orinoco, and other rivers, a vast efflux of water falls into the Equatorial Sea, more particularly in the wet season : what effect this water may have on the current is not fully ascertained.* But we learn, from the *Derrotero de las Antillas*, that, "Off the coasts of Guyana there are two currents : 1st, The general or equinoctial current, and another caused by the tides ; the boundary of the first is twelve leagues from shore, or in the depth of 9 fathoms of water, from which, toward the shore, that of the tide is experienced. The ebb sets to the N. E., and the flood toward shore. In the Gulf of Paria, also, the tide influences the currents.

"In the southern straits, or channels, of the Antillas, the velocity of the current *inward* is seldom under a mile an hour ; but its changes are so great, that it is impossible to point out its exact direction, or to establish any general rule for its velocity."

The ROLLERS, or HEAVY GROUND SWELL, of the north-eastern portion of the Antillas, which has, from time to time, produced so much mischief, was first described by Mr. R. H. Schomburgk, as shown in the Journal of the R. Geographic Society, 1835, and copious extracts from the same are given in the third volume of the 'Colombian Navigator,' to which the reader is referred for a more complete explication of the subject.

This phenomenon appears to be caused by the meeting and combination of the drift from the N. E. and the Equatorial Current from the S. E. or S. S. E. It rises, rages, and subsides, says Mr. Schomburgk, when the air is calm, when there has been no indication whatever of a previous gale, or even when light airs have, for a considerable period preceding, come from the southward of east. The waves approach in gentle undulations, but suddenly swell against the shore, and break with the greatest impetuosity. The rise takes place sometimes gradually, but more frequently quite unexpectedly, the waves reaching an uncommon height.

A heavy 'Ground Sea' is distinguished by something grand and sublime. The sea approaches in undulating masses, which suddenly rise to large ridges, crested with foam, and form billows that burst upon the beach with the greatest impetuosity ; the spray flying, where the waves dash against cliffs, often more than 100 feet high, attended with loud roarings resembling thunder, which subside into a rumbling noise, caused by the nodules and fragments of rock with which the breaker was charged when advancing, which on its retreat roll backward, and are again driven forward by the next surge. Wave then follows upon wave in quick succession, there being apparently only a short interval after the third. The sea for many miles from shore assumes a peculiar aspect, different tints of blue, from the lightest to the darkest, forming a strong contrast with the snowy foam of the breaking waves, when they strike against a hidden rock, or with the white line visible along the whole coast. The eastern Bahamas, the north-eastern coasts of Jamaica and Hayti, but chiefly Porto-rico and the Virgin Islands, and, in a less degree, the northern Caribbee Islands, are subjected to this ground sea.

It may be considered as a rule that, whenever the wind gets to the northward of east for a day or two, there will be a *ground-sea* on the northern side of the islands. The friction of

* M. de Humboldt says, however, that the influence of the most considerable rivers of America, such as the Marañon, the Orinoco, the Magdalena, and the Missisipi, is restricted within much narrower limits than is generally thought. But see Capt. Sabine's Remarks, page 189, hereafter.

the wind on the surface of the water causes little elevations or ridges, which by continuance of the force gradually increase, chiefly when the wind sweeps over a great extent of water. Finding no resistance, and having sufficient depth to sink directly down, they proceed with the direction of the wind and remain natural waves, until they meet repercussion from dashing against the shore, when they rise to an elevation much above their natural state.

The period when the ground-sea sets in is generally *October*, and it continues, though with some intermission, till April and May. The wind accompanying or preceding a ground-sea is, generally, from the east of north; the winds are, therefore, propelled more or less in a western as well as southern direction, and the Bahamas and even Bermuda may escape, whilst the islands from Barbadoes to Porto Rico, but more particularly the latter and the Virgin Islands, receive its first impulse."

A southern gale will likewise produce a heavy swell on the southern side of these islands; and, during the gale of the 30th and 31st of August, 1833, this was felt with great violence on the southern shore. But, generally speaking, neither in force nor duration are these surges to be compared with those of the northern side; the groupe of the Virgin Islands being protected, in this direction, by the Caribbean Islands or by the Colombian coasts, and not exposed to the swell of the main ocean."

To one who crosses, during a severe ground-sea from the southern side of Tortola to the northern, where the breadth of the island is inconsiderable, the singular spectacle is afforded of the sea which, on the southern side is perhaps 'as smooth as glass,' on the northern shore tossing, foaming, and roaring, as if agitated by a severe gale. The effect is most curious, and if it were not for the warning that is heard long before the cause becomes visible, one might fancy the wand of a magician in action.

The northern coast of *Porto-rico* is subjected to a ground-sea, of scarcely less force, and which has had the same effect on its coast as that of the Virgin Isles. The 'Old English Pilot' observes that the sea along the north coast of *Porto-rico* "beats sometimes very ragingly." The force of the waves that batter against the cliffs on which the Moro stands is amazing; and any observer will admit that the spray is sometimes carried more than a hundred feet high. It has been said that, several years ago, a brig, in consequence of carelessness, here became unmanageable, and was soon dashed to pieces against the cliffs, but few of the crew escaping.

Of the currents in the vicinity of *Anegada* and the *Virgin Islands*, Mr. Schomburgk says, "It is well known that the tropical current caused by the earth's rotation sets to the westward, and its grand movement in these latitudes is directed through the Caribbean sea; but it is probable that a branch of it, turned aside by the north-eastern coast of South America, sweeps along the Caribbean Islands to the N.W. till it reaches the Bahamas; and it is this branch which, at present, attracts my particular attention, and in proof of the existence of which I adduce the following remarks:—

Vessels bound from America to the West-Indies, and chiefly to *St. Thomas'*, frequently find themselves to the north of the *Virgin Islands*; and this deviation from their intended course has proved but too often fatal, having brought them on the reefs of *Anegada* when they thought themselves far to the southward of that dangerous island. Nor can repeated occurrences like these be attributed exclusively to errors in the observations for determining the latitude, or to false reckoning."

The American brig *William and Thomas*, left New York on the 28th of October, 1829. Made Bermuda on the 7th day after departure, when contrary winds retarding her course, land was discovered in the morning of November 15: according to reckoning it was supposed to be *St. Martin's*; but it was fortunately known, on approaching, to be *Virgin Gorda*; or probably in the night the vessel would have gone on the reefs of *Anegada*.

The English brig *Francis*, bound from Nassau, in New Providence, to Trinidad, cloudy weather having precluded an observation for several days, was supposed to be far distant from *Anegada*, but making land in the evening, supposed to be *St. Martin's*, was wrecked at 11 p. m. on the reefs of *Anegada*.

The American brig *Lewis*, bound from Philadelphia to *St. Thomas'* and Maracaybo, and supposed on the day previous to be on the parallel of *St. Thomas'*, was wrecked on the south-eastern reef of *Anegada*, 9th of April, 1831.

During his continuance at *Anegada* Mr. Schomburgk acquired additional proofs of the existence of a north-westerly current. He found on the south-eastern reef several buoys

with tye [coir?] ropes attached to them, which appeared to come from St. Martin's. On the 24th of September, 1831, after a severe gale, two buoys were found on the same reef, which had probably been attached to anchors on some ground to the S.E.

On sounding between Virgin Gorda and Anegada Mr. Schomburgk threw the log every 30 minutes, and taking bearings of some remarkable objects, the drift was found to be always westerly; and the result appeared to be the same whether the tides set north or south. On one day he left his anchorage, and sailed ten miles to the northward of Anegada, where the boat was lowered, and rendered stationary, by mean of a kettle filled with stones, it being then southern tide; in spite of which the log was carried N.W. by W. A similar experiment was made in the waters between Virgin Gorda and Anegada, with the advantage of anchoring; and the set was always the same, the drift being nearly one knot.

The north-western or ebb tide, between Anegada and Tortola, is much stronger than the flood to the S.E.; undoubtedly from the circumstance that tide and current work the same way.

On these circumstances Mr. Schomburgk observes that the wind, from March to June, frequently blows from the south and S.E., and the velocity of the N.W. current will be thus increased; in consequence of which, vessels bound, during that time, for these islands, are more subject to error in their course than at any other period: and lighter bodies being more influenced by currents than heavier ones, may be taken as the specific cause of the last remark.

The following facts establish the existence of the combined currents; and they show, in some degree, the force and direction toward the Brazilian coast.

CANARIES TO BRASIL.—In June and July, 1795, the *Bombay Castle*, East-Indiaman, from the Isle of Palma (of the Canaries) and the Coast of Brasil, experienced a westerly current, amounting to $6\frac{1}{2}$ degrees. *39 miles.*

On May 20, 1802, the *Cuffnells*, East-Indiaman, lost the N.E. trade in $8\frac{1}{2}^{\circ}$ N. long. 22° . Gained the S.E. trade, June 4, in 5° N. long. 21° . From the equator the current was found to set West and W. by N. from 30 to 52 miles daily, till the coast of Brasil was in sight on the 14th, in 8° S.

May 23, 1802, the *Sir Edward Hughes* lost the N.E. trade in 6° N. long. 23° , and the wind was from S.S.E. on the 25th in 5° N. and $23^{\circ} 30'$ W. The trade kept far at southward, and the current set strongly to the West.

October 16, 1805, the *Europe and fleet* lost the N.E. trade in 11° N. long. 28° , and gained the S.E. trade on the 26th, in 4° N. long. 29° . On the 4th of November, the land of Brasil was seen in lat. 6° S., the wind near the land was at E. by S. and E.S.E. By proceeding too far to the westward, two ships of the fleet were wrecked in the morning of the 1st of November, on the Roccas, or low Kays, in lat. $3^{\circ} 52'$ S. and $33\frac{1}{2}^{\circ}$ W., and several others had nearly shared the same fate. This catastrophe had probably been avoided by a due knowledge of, and attention to, the effects of the current; which was subsequently ascertained to set $2\frac{1}{2}$ miles per hour to the westward, near the Roccas.

On the 1st of June, 1793, the *King George*, East-Indiaman, crossed the line in 30° W., and, from the second to the fifth, experienced a westerly current of $1^{\circ} 33'$. On the 5th, Cape St. Roque was in sight, and the ship was kept working until the 10th, endeavouring ineffectually to weather it; she then stood to the north-eastward, closely hauled, to latitude 1° N., in order to regain the variable winds in North latitude, and then proceeded to cross the equator, which was, at length, effected.*

In May and June, 1807, the *transports, laden with ordnance stores*, for the army at Monte Video, by crossing the equator too far to the westward, were carried so far in this direction by the current, that they could not get to the southward of Cape Augustin, (lat. $8^{\circ} 23'$ S.) and were twice obliged to stand to the northward, into variable winds, to regain Easting, after having attempted ineffectually to gain the regular S.E. trade-wind.

II. M. ship *Tartar*, Capt. T. Brown, on returning from South-America, in November,

* In latitude $5^{\circ} 6'$ S. longitude $35^{\circ} 43'$ W. to near the coast and the meridian of 38° , the *Inconstant* frigate was carried by the current 47 miles N. 73° W. in 24 hours, 1st April, 1814.

1825, was found to be affected daily by a current between the latitudes of $0^{\circ} 8' N.$ and $4^{\circ} 53' N.$ (longitude beyond $24^{\circ} 30' W.$) in a period of three days 87 miles N. $44^{\circ} 27' W.$ (*true*) equal to 29 miles a-day.

It is a well-known fact, that several ships have made the Isle of Fernando Noronha,* on their outward-bound passage to India, by the currents having set them to the westward, after the failure of the N.E. trade-wind. The current runs strongly about this island.

And, in 1770, a small vessel laden with corn, and bound from the island of Lanzarote, one of the Canaries, to Santa Cruz, Tenerife, was driven to sea, while none of the crew were on board. The motion of the waters, to the south and west, carried it to America, where it went on shore, at La Guayra, near Caraccas.

CAPE VERDE ISLANDS TO HAYTI.—A bottle from the ship *Duke of Marlborough*, by Mr. Geo. Thom, in latitude $16^{\circ} 22' N.$, longitude $26^{\circ} 31' W.$, 14th of October, 1820. Found, 24th of July, 1821, at *Agujero Chico*, or Petit Trou, on the south coast of Hayti, and made public by Captain James Robinson, of the brig *Endeavour*, of Liverpool.

EQUATORIAL SEA TO BARBADOES.—A bottle from the *Stratford*, of London, Capt. Abyah Locke, on her return from Otaheite, 21st Jan. 1836, in latitude $4^{\circ} 7' N.$, long. $24^{\circ} 17' 15' W.$, found on the northern extremity of Barbadoes, 8th June, 1836, its direction apparently having been about W.N.W. $\frac{3}{4} W.$ *true*, and distance 2100 miles.

By the *Jane*, Captain Livingston, toward Demerary, between lat. $14^{\circ} 7' N.$, long. $44^{\circ} 6'$, and lat. $6^{\circ} 53'$, long. $57^{\circ} 18'$, in six days, ending 30th April, 1826, the sets of current were, $33' 10'' N.$ $21' 25'' S.$; $0' 0'' E.$ $3^{\circ} 16' 50'' W.$ *Surplus effect* (or equatorial current) $11' 45'' N.$ and $3^{\circ} 16' 50'' W.$

In November, 1825, between Maranham, on the north coast of Brasil, and latitude $6^{\circ} 8' N.$ long. $47^{\circ} 17' W.$ Captain Livingston was set $1^{\circ} 12' 35'' N.$ and $1^{\circ} 55' 28'' W.$ *without any southerly or easterly differences.*

On proceeding toward England, in July, 1826, Captain Livingston, from Demerary to lat. $24^{\circ} 55'$, long. $59^{\circ} 24'$, in eleven days, found the sets $1^{\circ} 18' N.$ $0^{\circ} 0' S.$; $1^{\circ} 0' E.$ and $3^{\circ} 7' W.$ *Surplus effect*, $1^{\circ} 18' N.$ and $2^{\circ} 7' W.$

OFF GUYANA, H.M.S. *Racehorse*, Captain J. Everard Home, on the passage from Barbadoes to Para, lat. $8^{\circ} 36' N.$, long. $52^{\circ} W.$, at one and a quarter *p. m.* fresh breeze from E.N.E., found the current during the last 24 hours had set N. $25^{\circ} W.$, 16 miles.

EQUATORIAL CURRENT TO TRINIDAD.—A bottle, (No. 267,) from the *Osprey*, of Glasgow, at noon, on the 17th of January, 1822, in latitude $6^{\circ} 13' S.$, and longitude $15^{\circ} 35' W.$ Found on the 27th July, 1822, in Mayaro Bay, Island of Trinidad, latitude $10^{\circ} 15' N.$, and longitude $61^{\circ} 2' W.$

EQUATORIAL CURRENT TO TOBAGO.—A bottle from the schooner *Julia*, Wm. Davidson, master, in latitude $6^{\circ} N.$, and longitude $40^{\circ} W.$, Nov. 6, 1821. Found 7th of March, 1822, near the shore of Little Rocky Bay, Tobago.

EQUATORIAL CURRENT TO BARBADOES.—In the night of the 5th of June, 1827, during hazy weather, H. M. Packet-ship *Cynthia*, commanded by Lieutenant White, grounded on the reef extending from Kendal Point, on the south side of Barbadoes. Upon this reef she was driven by the current, which then ran with very unusual and extraordinary strength, and soon became a complete wreck.

In June, 1828, the ship *George*, of Bristol, bound to St. Vincent's, ran ashore near the same place and was likewise wrecked. We attribute this to the current, as well as the wreck of the *Cora*, Capt. Abbott, here lost on the 4th of September, 1826. In the last case, the wind, which had been blowing from the S.E., suddenly shifted due South, and the vessel having previously lost her mainmast in a hurricane, was unmanageable.

The bark *John Stewart*, Rimington, master, from Demerary to London, with the wind blowing fresh from E.N.E., struck on the *Cobblers*, upon the S.E. side of Barbadoes, at 5 *a. m.* 17th January, 1834, and became a total wreck. The crew, with difficulty, gained the shore, and were therefore saved. We think that this may be fairly included in the losses produced by the current.

GUYANA TO ST. VINCENT'S.—A bottle thrown into the sea on the 20th May, 1835, in the

* Latitude $3^{\circ} 55' S.$ longitude $32^{\circ} 28' W.$ or thereabout.

latitude of Demerary; picked up in Sable Bay, St. Vincent's, on the 24th June. At the same time several large trees were washed ashore, among them a Spanish cedar, and which, from their appearance, (being covered with a coat of barnacles and sea-weed,) must have been a long time in the water: these were, no doubt, driven out to sea by the overflowing of the Orinoco, occasioned by the heavy rains.

Some years back a very large cedar came on shore at Sable or Sandy Bay, bringing with it a large female *boa constrictor*, which took to the neighbouring wood, and when shot, some days after, was found to contain many young ones, nearly ready to escape; and which, but for the destruction of the old one, would have taken up their abode in the woods.

EQUATORIAL CURRENT TO MARTINIQUE.—A bottle from the ship *Osprey*, of Glasgow, latitude $5^{\circ} 12' S.$, longitude $24^{\circ} 40' W.$, 28th of March, 1820. Found 4th of February, 1821, near the eastern point of the Salines, quarter of St. Anne, Island of Martinique. Attested at St. Pierre, Martinique, 13th of February, 1821, by Monsieur T. Bournant, Printer, and Director of the General Post Office at that place.

A bottle, thrown from the *Osprey*, at noon, on the 1st of April, 1820, in latitude $12^{\circ} 56' S.$, longitude $29^{\circ} 10' W.$, was found 10th of June, 1820, on the Barra Grande, coast of Brasil, latitude about $9^{\circ} 20' S.$ Its true direction seems to have been N.W. by W. $\frac{1}{4}$ W. Attested by Messrs. Lowe and Co. of Maçao, in the province of Pernambuco.

CAPE VERDE ISLES TO BRASIL.—The *Hazard*, of Greenock, August 4th, 1812, lost the N.E. trade in latitude $11^{\circ} N.$, longitude $25^{\circ} W.$; and the wind, until the 12th, varied from West to S.W.: from the 12th to the 17th it generally blew from South, never exceeding one point easterly. Gained the S.E. trade on the 17th, in latitude $2^{\circ} N.$, longitude $27^{\circ} 30' W.$; the trade kept southward between Penedo de S. Pedro, or St. Paul's Islets, and the coast of Brasil (at Rio Doce) and experienced a westerly current amounting to nearly four degrees. Attested by Capt. J. W. Monteath.

BETWEEN MADEIRA AND BRASIL.—In the *Jane*, Capt. Livingston, April and May, 1824, found a surplus effect of currents between Madeira and Brazilian Trinidad, in 39 days, equal to $1^{\circ} 19' 47'' S.$, and $6^{\circ} 3'' W.$

Finally, Captain Sabine has shown that, in 1822, after H.M. ship *Pheasant* sailed from Maranh, she entered the current, the full strength of which she had quitted to go to that place, and it was then found to be running with the astonishing rapidity of 99 miles in 24 hours. On the 10th of September, at 10 a.m. while proceeding in the full strength of the current, exceeding four knots an hour, a sudden and very great discoloration of the water ahead, was announced from the mast-head; the ship being then in $5^{\circ} 8' N.$ and $50^{\circ} 28' W.$ (both by observation,) it was evident that the discoloured water could be no other than the stream of the Maranon, pursuing its original impulse at no less than 300 miles from the mouth of the river, its waters not being yet mingled with the blue waters of the ocean, of greater specific gravity, on the surface of which it had pursued its course. It was running about 68 miles in 24 hours.

Thus, as the Baron de Humboldt says, "The discovery of a group of uninhabited islands is less interesting than the knowledge of those laws which link together a considerable number of insulated facts."

It has been shown in our volume on the Southern Ocean, that, on the Eastern Coast of Brasil, between the months of September and March, the winds more commonly prevalent are from N. by E. to N.E. by E.; between March and September, the prevailing winds are chiefly from E. by N. to E.S.E.

The former of these is generally termed the NORTHERLY MONSOON, and the latter the Southerly one; although there appears, in fact, to be no direct and opposite change in them on or about the equinoxes, as is generally the case with the winds so called. These winds being simply a continuation of the S.E. trade, which changes its direction as above described, and as influenced by the land on its approach thereto.

Under the operation of the winds, and according to their changes, the currents must, consequently, vary; and a reasonable allowance for them will be made according to the judgement of the navigator.*

* See farther, as to those on the Coast of Brasil, and between Brasil and Guinea, *The Sailing Directory for the Ethiopic Ocean*.

From the month of March to that of September, it may be presumed that they set most to the northward; on the contrary, between September and March, more to the southward.

There can scarcely be a doubt that, with change of season, there is a considerable variation in the course and breadth of the Equatorial Current. Northerly winds may press it toward the shore of Guyana, &c., and other circumstances disperse it over the ocean to the eastward. Of such variations a singular instance has been related in the Spanish *Derrotero*, which appears quite contrary to preceding experience; but it is given on the most respectable authority, and is, therefore, subjoined.

EASTERN BRANCH OF THE EQUATORIAL CURRENT.

In no part of the ocean, perhaps, have mariners been more at a loss, in accounting for the current, than in that near the Equator, between the meridians of 25° and 40° W.; not being aware of the powerful effect of the African S.W. monsoon, &c. noticed in page 180) and which prevails from the beginning of June to October. The effect of this, and the change of season, is to divert a great portion of the Equatorial stream to the North, N.N.E., and N.E., even to and beyond the Cape Verde Isles.*

By actual trial and much trouble, Captain Cheveley, of Liverpool, in June, 1830, found the hourly drift between Cape Verde Islands and the Line as follow:—

Latitude 9° N. long. 33° W., N.N.W. one mile; lat. 7° N. long. 31° , North, three-quarters of a mile; latitude 6° N. long. 33° , N.N.E. half a mile; on the Equator, near long. 40° , strong N.N.E. one mile and a quarter; but, on rounding Cape St. Roque, in about 5° S. the current was found setting *westward*, three miles an hour.

And, even to the N.W. of the Cape Verde Isles, between latitudes 23° and 20° , longitudes 23° , 24° , Captain Cheveley had found a current to the N.E. of one mile an hour: and, in lat. 18° , long. 25° , it was found in the same direction, one mile and a half. To the westward and S.W. of the isles, in lat. 14° , long. 26° , N.N.E. half a mile.

It will probably be found, at a future time, that the current changes more regularly than is commonly supposed, and a further investigation of it is certainly among the desiderata of navigation.

Major Rennell has said, "Experience most fully proves that, although nature effects all her operations in such a manner as that, ultimately, the whole system is balanced and preserved, yet that, in detail, she often appears irregular, according to our limited comprehension. The trade-winds and the currents of the ocean partake of these irregularities, although the general system is upheld. The trade-winds in the Atlantic are often unsteady, even to five or six degrees within their northern boundary; and instead of N.E. winds there are found N.W., and even S.W. winds for many days consecutively: and this state of things prevents the *drift* current from being so regular there as in the heart of the trades.

"Anomalies also take place in the great Equatorial Current, and in that of the S.E. trade. The former has been known, at one time, to run to the eastward, or directly opposite to its general, and as is commonly understood, perpetual, course; and at about the same rate; and with it, the whole mass of water, from 5° N. to 12° S. At another time, a like anomaly took place, between the parallels of 2° N. and 7° S. This latter was *observed to take place* at six or seven degrees to the eastward of Cape St. Roque; but the other about mid-way between the two continents. In a third case, nearly in the middle, the current *ceased altogether*; or rather there was neither an easterly nor a westerly current. This happened in February; the other two in July and August." (pp. 66, 67.)

* The American exploring squadron, which left Madeira on the 25th of September, 1838, after passing the parallel of the Canary Islands, experienced a north-easterly current, of about half a mile an hour, where a current in a south-westerly direction is generally supposed to prevail; this continued until they reached the latitude of Bonavista. Captain Wilkes says: "We hove-to and tried the current morning and evening, and always found the same result." The current-log used was two kegs, with a distance line of five fathoms between them, the lower one being just loaded sufficiently to sink the air-tight one under the surface of the water, with the usual log-line attached to the centre of the distance line, precluding the possibility of its being a surface current: besides which, the dead-reckoning of the ship, and our observations, gave the same result.

On the 29th of September the squadron passed into coloured water, quite as green in appearance as that of 50 fathoms in depth on soundings. On entering it the temperature decreased one degree and a half, and rose two degrees on leaving it. The vessels continued in it until the 2nd of October, having then run a distance of 450 miles. They repeatedly sounded with from 100 to 300 fathoms of line, but no bottom was found.—*Athenæum*, 21st Sept. 1839.

The instance above alluded to, as given in the Spanish *Derrotero*, is as follows :—

The deceased Admiral Don *Cosmé de Churruca* (as before mentioned, page 173,) sailed from Cadiz, on the 15th June, 1792, for the purpose of surveying the West India Islands and Spanish Main. On the 6th July he crossed the Tropic of Cancer in $28^{\circ} 56'$ West of Greenwich, without having discovered any error in the dead-reckoning; neither did they find any on the 8th; the trade-wind was then fresh, and it was remarked that it attained the greatest strength when the sun was on the meridian, by night as well as by day. This phenomenon, which continued during the subsequent days, is precisely contrary to what had been observed when the sun was to the southward of their zenith; and, the writer observes, “according to the general theory of the winds, it appears that the breeze ought to freshen when the sun passes the meridian, in all cases except when the declination is equal to the latitude in which the observer is placed. It is desirable that all navigators should note in their journals the times and circumstances under which they experience the greatest and least force of these general winds; for such observations, frequently repeated, might furnish knowledge which is a *desideratum*.”

“On the 10th of July they found a current of one mile and a tenth per hour, setting $N. 49^{\circ} E.$, reckoned for two days; care had been taken to heave the log very frequently, and always on any alteration of the sail carried. Their course was $S. 64^{\circ} W.$ From the 10th to the 12th they also found a current setting $N. 31\frac{3}{4}^{\circ} E.$, nearly a mile an hour; from noon of the 12th, to noon of the 14th, the current had carried the vessel to the $N.E. 44\frac{1}{2}$ miles out of her course: and at noon of the 15th, 17 miles $N. 21^{\circ} W.$

“At noon of the 17th they found that, in the preceding 48 hours the vessel had been carried 43 miles to the $N.E.$ of her reckoning. On the 18th, in the evening, they saw the island Tobago bearing $S. 55^{\circ} W.$ By making this island they found that the reckoning by account was $2^{\circ} 13' 45''$ *a-head* of the ship; equal, in this parallel, to $43\frac{1}{2}$ leagues; and Don *Cosmé* thereupon made the following reflections :—

“In ten days, between the parallels of $21^{\circ} 45'$ and $11^{\circ} 44'$, and the meridians (West of Greenwich) of $33^{\circ} 30'$ and $59^{\circ} 50'$, the vessel was set $2^{\circ} 48' 27''$ to the north, and $2^{\circ} 27' 45''$ to the east, of dead-reckoning, or $71\frac{1}{2}$ leagues, as if they had experienced a daily current of $21\frac{1}{2}$ miles, setting $N. 38^{\circ} E.$ This great error cannot be attributed to any carelessness in making up the dead-reckoning, nor to its insufficiency; for it is known that a log-line marked to $50\frac{3}{4}$ English feet, between knot and knot, ought not to measure distances greater than those sailed; and, consequently, it must be concluded that they had a constant and powerful current setting them to the $N.E.$

“There can be no doubt, Don *Cosmé* says, of the existence of a current to the westward in the tropical zone: the action of the moon must necessarily produce it; and the experience of navigators who have generally found their vessels *a-head* of their dead-reckoning on making the coast of America. The constant action of the trade-winds must also co-operate, and it would be temerity to oppose an opinion so satisfactorily established, and so generally adopted. My own observations are, however, certain; my dead-reckoning was most circumspcctedly and prolixly made up, and there can be no possibility of a doubt that we experienced a current to the $N.E.$ The thing is certain; and now let us try to reconcile these circumstances, which appear so contradictory.

“From the month of May till November, the rains are continual and copious on the continent and islands of America; in consequence of which the rivers ought to be increased, not only in size, but in velocity of movement. The number of these rivers is very great, and their united action must be very considerable on the waters of the ocean; and it may be the mean of destroying the Equatorial Current, and of making one in a different direction. On the one hand, as the rainy season is also the season of the hurricanes, and that in which least navigation is carried on, the currents during that period have been less particularly (or seldomer) examined; and consequently little is known of the currents produced by the rivers; while, on the other side, as the principal navigation is made in the months which have no rain, and in which the rivers have no considerable force sufficient to destroy the Equatorial Current, it follows that the majority of navigators find currents setting westward.

“Should the foregoing reasons prove correct, it will follow that, from November till March, currents may be found setting to the westward, and during the other months of the year to the north-eastward.”

It may be seen, by reference to our next division, on the currents of the Caribbean Sea, &c.,

&c., that this idea of the Spanish commander is not merely chimerical. For it is shown that, during the *rainy* season, the current on the Colombian shores often sets to the eastward; thus uniting with the Equatorial Current, and forming an outset from the Caribbean Sea. There may probably be, at all times, a southerly re-flow on shore.

6. THE CURRENTS OF THE COLOMBIAN OR CARIBBEAN SEA, AND THE MEXICAN STREAM.

"On the Colombian coast, from Trinidad to Cape la Vela, the current sweeps the frontier islands, inclining something to the south, according to the Straits which it comes from, and running about a mile and a half an hour, with little difference. Between the islands and the coast, and particularly in the proximity of the latter, it has been remarked that, the current, at times, runs to the West, and at others, to the East. From Cape la Vela, the principal part of the current runs W.N.W.; and, as it spreads, its velocity diminishes: there is, however, a branch, which runs with the velocity of about a mile an hour, directing itself toward the coast about Cartagena: from this point, and in the space of sea comprehended between 14 degrees of latitude and the coast, it has, however, been observed, that, in the dry season, the current runs to the westward, and in the season of the rains, to the eastward.

"On the Mosquito Shore, and in the Bay of Honduras, no rule can be given for the alterations of the current. All that can be said is, at a good distance from land, it has generally been found setting toward the N.W.

"In crossing from the coast, or from Cartagena, to the islands, it has been observed, that, from La Guayra to the eastern part of Hayti, on a voyage made in December, a difference of 106 miles to the westward was found during the seven days the voyage lasted."—*Derrotero de las Antillas*.

The Baron Alexander von Humboldt, in describing his passage from Cumana, westward, to La Guayra, has said, "The general motion of the waters between the tropics toward the west, is felt strongly on the coast during two-thirds of the year only. In the months of September, October, and November, the current often flows toward the *East*, for fifteen or twenty days in succession. Vessels on their way from La Guayra to Porto-Cabello have been known to be unable to stem the current that runs from West to East, although they had the wind astern. The cause of these anomalies is not yet discovered. The pilots think that they are the effect of some gales of wind from the N.W. in the Gulf of Mexico. Yet these gales are much more violent in spring than in autumn. It is also remarkable that the current to the East precedes the change of the wind. It begins to be felt, at first, during a calm; and, after some days, the wind itself follows the current, and becomes fixed in the West."—*Personal Narrative*, Vol. III. 378.

Captain C. S. Cochrane, R.N., in his Journal, 16th March, 1823, says, "In the afternoon we perceived high land through the haze, and hauled up for it, wishing to make a point about 50 miles to windward of Santa Marta; but, on getting in-shore, we found that we were seven miles to *leeward* of that place; the current from the eastward having been running for the last 24 hours upward of two and a half knots an hour; which agrees with Baron Humboldt's account, that the current runs from one and a half to four knots an hour, according to the force of the wind and season of the year. The natives say that the moon likewise has a considerable effect on this current, which, at the changes of new and full, runs to the *eastward* for twenty-four hours.

"Here I must caution all captains of ships navigating on this line of coast, to allow for the current, in general, at least one knot and a half per hour, on an average, with an increase in proportion to the strength of the breeze, and an abatement at the new and full moons: otherwise vessels heavily laden, overshooting their ports, may lose as much as three weeks by having to stand away nearly to the Antillas before they can get sufficiently to windward to gain the port they have missed; and even men of war run a risk of carrying away spars and masts in beating up."—*Vol. I. p. 52.*

In the third volume of the 'Colombian Navigator,' 1839, may be found "Remarks on the Currents of the Atlantic and West-Indies, made by Lieut. A. H. Bisschop Greevelink, in the *Echo*, a brig of the Dutch Royal Navy, during four years of service, 1833-1837," and which describe the route of that vessel from England to Surinam, in August and September,

1833. On the evening of the 13th of the latter month the *Echo*, having arrived in latitude 17° N. and longitude 35° W. lost the trade wind, and the wind then shifted to the N.W. with a strong breeze, gloomy weather, and much rain, during the 24 hours. The following day the wind diminishing, passed to the S.W. and S.S.E., and terminated in a calm; currents weak and variable to the S.W. and eastward.

On the morning of the 16th, in lat. $14^{\circ} 40'$ and long. $36^{\circ} 20'$, a light breeze sprung up from the S.E., and from that time till we reached the coast, we had to struggle with a never-ceasing variety of wind and weather, continual rains with squalls, and scarce a day passing without lightning in one or other quarter of the horizon. On the 18th we passed by several riplings or eddies, being then in lat. 12° and long. $39^{\circ} 30'$ W. They usually stretched from east to west, and were often seen to cover the whole surface, everywhere boiling and bubbling as in a caldron. Current always weak, and during the last 48 hours to the west and W.N.W. at a rate of half a mile an hour.

After losing the trade-wind we had to creep over more than 900 miles, as the wind had left us, in every appearance, for ever; the rains were copious and continual in this space, and lightning was seen very frequently. On the 18th, (lat. $11^{\circ} 52'$, long. $39^{\circ} 25'$) we passed through a number of eddies; and on the 24th (lat. $8^{\circ} 3'$, long. $45^{\circ} 37'$) the first indication of a change in the colour of the sea became visible; yet it was slight, and may be attributed to a branch of northerly current observed in the succeeding day. On the 27th (lat. $5^{\circ} 52'$, long. $48^{\circ} 38'$) we received a gentle S.E. breeze, which brought us, though slowly, toward the coast. In the night of the 28th (lat. $5^{\circ} 7'$, long. $49^{\circ} 56'$) we crossed the edge of meeting currents from the Ethiopic Ocean and Brazilian shore and from the Marañon; after which we entered the boundary of the tides. In the evening of Sept. 30, came to anchor in $5\frac{1}{2}$ fathoms. In the night observed longitude by chronometer, $54^{\circ} 11' 45''$.

Although we had not seen land since we lost sight of the Lizard, by which to examine our time-keepers, I felt not the least doubt about their rate (the one a *Knebel* and the other a *Parkinson* and *Frodsham*) by their reciprocal conformity, corroborated by my lunar observations (which by-the-bye I think are never to be neglected), and as I was desirous to obtain some observations about the currents, so peculiarly remarkable in these seas, I took every opportunity which circumstances allowed, to satisfy my curiosity on this subject.

On the 22nd of September and subsequent days, the riplings became less in number; and, on the 24th in the afternoon, about the 8th degree of latitude and 46th of longitude, we perceived the first change in the colour of the water, from the common blue to a somewhat darker hue, and as this was a somewhat uncommon case, I attributed it to a branch of current observed the following day at noon, setting due north, at the rate of more than one mile an hour, straight across a south-easterly current observed during the preceding days, mingling the muddy waters of the Marañon and other rivers with those of the ocean. From the 24th till the 28th nothing particular occurred; we were always steering to the S.W. with light variable winds, and a continuance of rain sufficient to penetrate our very bones. Currents weak and changeable, being lastly observed to have run N. by W. 18 miles in 24 hours. This at present I call weak, being afterward accustomed to fall in with a velocity of twice and thrice that number of miles. At noon we altered our course to W.S.W. being then in lat. $5^{\circ} 7'$ and long. $49^{\circ} 55' 55''$.

In the night, however, having a lunar altitude, we were not a little surprised at finding the ship thrown 35 miles to the northward of her supposed situation, although I may say to have been prepared for this occurrence by Capt. Edw. Sabine's relation in the *Memoir*, whose track we were crossing just then, in the same month.

At break of day we saw the water totally altered in colour, and thickly mingled with mud, as if we were sailing in a flood of ochre; hove the lead, and found 45 fathoms, fine sand, white and black. At 7 in the morning, by chronometric observations, I found the westerly offset $33' 38''$, and finally at noon, in lat. $5^{\circ} 21' 49''$ and long. $51^{\circ} 46' 15''$, it appeared evident that the current, in the last 24 hours had been running with the rapidity of 67 miles to the N. 30° W. In the afternoon we perceived the land toward the S.W. by S., being the *Family Islands* of Cayenne, and at the same time we entered the boundary of the tides.

This, indeed, seems to confirm the opinion of those seamen who attribute the principal strength of currents hereabout to the waters of the Marañon, &c. predominating over those of the ocean; but this is to be admitted in a partial degree only; for, as operating on the general direction of the Equatorial Current, I esteem it as of no influence at all."

The numerous voyages made by the *Echo* in the West-Indian seas, with a particular detail of each, more especially in regard to the Currents, are given in the volume above-mentioned; and from these voyages and experiments the general inductions are that, between the Caribbee Islands and the coast of Guyana, in the months of August, September, and October, the current veered to the northward of north-west, and in other months more westerly, or even to the southward of west, as in November and December 1834; but we learn, also, that the greatest velocity of current has been observed in August and September, when the Marañon is at its lowest level, as well as in December and March, when this river begins to increase and attains its greatest height; even on examining the details, in order to discover any regularity in its force, we find an irregularity reconcileable only with that of the wind; and, more generally, by applying the theory of trade-winds and their influence upon the surface water of the ocean.

After having once rebounded from the Brazilian coast, the united Equatorial and Ethiopic currents are again compelled to retire westward by influence of the S.E. trade-wind, (apparently also by the disposition of the waters in these regions to retire westward); and, although at passing the Marañon, which disembogues toward the N.E., the combined current may, in some degree, and according to its variable form and strength, derive an impulse to the northward, yet it soon yields to the force of the N.E. trade-wind, and the south-westerly drift thereby produced, which sets toward the Caribbee Islands.

In proportion to the force and extent of these winds, the general current is pressed toward the shore of Guyana, as in December, 1835, and November and December, 1834; or allowed to expand freely to the North, as in August, September, and October; yea, even to the N.E., as in March, 1837, especially when preceded by long and violent indraughts, and followed by calm weather.

By influence of the Marañon waters, the general current is prevented from sweeping the coast to the westward of Cape North; as the stream of this great river, being unobstructed, seems to gather all its strength, and force the western boundary of that gigantic drift to an uncertain distance from shore. In this manner we may account for the weak westerly current, creeping along that part of the coast comprehended between the Marañon and Gulf of Paria, called the *region of the tides*, and which is produced by the remaining effluxion of the Marañon, confined between the western border of the general current and the muddy banks of Guyana. It is incorrect to fix this border in 9 fathoms of water, as I have found it in twice and thrice that depth; but on the other hand, I think that, if what has been supposed by Admiral *Don Cosmé de Churruca* should ever again happen, I mean the destroying of the Equatorial current by the action of the rivers, the Atlantic will be found of a whitish hue, so far as these currents shall reach, because their thick muddy waters never mingle with those of the ocean until they have been subdued by, and at rest with, them.

The direction of Currents in the Atlantic is reconcileable with the force and direction of the Trade-wind, but not without exceptions; because the height of the water-level in the Caribbean Sea will sometimes baffle every calculation both within and without the range of islands, as shown indubitably by experiments founded, not only upon the method of ascertaining currents at sea, but also within sight of land, and observations made on shore along the coasts. It has also been found that, during calm weather, even with strong easterly winds, the currents have sometimes been running for days together to the eastward, especially in the latter parts of January and July, when, by the then prevailing strong winds, the water is heaped up in a very uncommon degree, and the inner part of the Caribbean Sea, most probably overcharged, succeeds in re-establishing its equilibrium by forsaking the power of its wrathful driver. In this manner I think we ought to reconcile those circumstances mentioned by that illustrious Spanish commander.

In the Caribbean Sea, the force and direction of currents are more distinctly modified by the direction of the wind. With continual light winds and smooth water the currents are generally weak, augmenting only in proportion to the increasing wind; this may serve as a proof that, among other less perceptible causes, under which they are governed here, wind is the most powerful agent; for the indraught through the channels appears plainly to proceed from the force and extent of the trade-winds. In this sea, from the Windward Islands westward, to 72 degrees of longitude, the general direction of currents, observed during our four years' cruise, was N.W. and westerly; the weakest in October, November, April, and May; the strongest in December, January, February, and March, along the coast of Venezuela, and in July and August in the northern parts; but, in general, so much
always

always depended on the force of the wind, that, with few exceptions, *almost every voyage was affected by a force of current corresponding to that of the prevailing wind.*"

EXTRACTS FROM THE JOURNALS OF LIEUT. GREEVELINK.

"In January, 1834, the *Echo*, in crossing the Caribbean Sea, from Curaçao to windward, experienced a drift of 40 miles to the west, and escaped only by running straight for the coast of Hayti, beating to windward along that and the coast of Porto-Rico, with the best success, and even assisted by weak easterly currents when near the shore. Wind from the E.N.E., sometimes blowing a gale; but, when sheltered by the land, the water was tolerably smooth.

"In December, 1835, the *Echo*, then on her passage from Surinam to Curaçao, with sharp breezes, found the current sweeping through the channel between Tobago and Granada, and farther on, along the leeward islands, with a velocity of more than two miles an hour to the W. by N.: but, in October, 1836, on the same route, with light winds and calms, the water ran for days together to the northward, at the rate of only half a mile an hour.

"In March, 1836, the same vessel, from Curaçao to La Guayra, with very strong winds, spent six days in beating up against a current of 40 miles mean daily strength; and on the 8th of April left La Guayra for Porto Caballo, in the bight to the westward, when, instead of making this passage in some hours, she had, during three days, to contend with light, variable, and even westerly winds, and currents to the N.E. 15 miles daily.

"The Baron von Humboldt's remark about the increase of the currents near the Testigos proved true on our approach to the same islands, in December, 1835.* In the morning of the 12th, the longitude observed was $62^{\circ} 45' 15''$, and the difference West in 24 hours appeared to be $32' 15''$; shortly after, that cluster of rocks came in sight; and at noon, at the very moment that the sun passed the meridian, the S.W. island, placed by Don J. F. Fidalgo in $63^{\circ} 12'$, bore East, distance one mile, having run by log 20 miles to the W. $\frac{3}{4}$ N.: so that, during these last four hours, the westerly difference amounted to 8 miles, whereas in former watches, it was only $5\frac{1}{2}$ miles.

"A similar circumstance, we have reason to believe, also takes place at other groupes of this range of sunken islands, and near such capes as are low and reaching far out, so as to obstruct the motion of the water beneath, and thereby redouble the force of the surface current; as denoted by the many instances of shipwreck and carcasses of vessels, (sad admonishers of precaution,) spread among these flat barren rocks, and produced solely by the irregularity of currents, which baffle every calculation, even those of the coast traders.

"But this variety in the westerly currents here, is not the only cause of danger. The total change in the setting of the currents from west to east, is of a nature which requires the utmost care and attention, as they not only occasionally happen with calms, but also sometimes with fresh breezes from the eastward. One of the first-mentioned instances, particularly remarkable, we observed during our passage, in October, from Surinam, through the channel of Granada, toward Curaçao. On the 7th and 8th, between the Island of Tobago and Cape Malapasqua, the water flowed to the N. by E. and N. by W., with a trifling force; when suddenly, on the 9th, we had a difference of $17' 54''$ North, and $34' West$; and, on the following day, at the new moon, we were driven $11' 12''$ to the North, and $35' 54''$ to the eastward of our supposed situation. This case was too singular not to excite our attention, as the high mountains of Caracas showed us almost hourly the east or westerly direction in which we were driven; the weather being perfectly calm, and the water constantly smooth, by which means we were able to verify our chronometrical observations, and to remove every doubt respecting the truth of so extraordinary a circumstance, the result whereof was as follows:—

"By the westerly current we drifted in sight of the high land near La Guayra, and kept working up against the strong easterly set in the whole following day. On the 10th, from seven in the morning till four in the afternoon, we had 14 miles difference west, agreeing with the bearing of *Monte Avila*. From that time till six in the evening, when that mountain, of which we had lost sight for a moment by drifting to the westward, again became

* The Remark is as follows. The Baron, on approaching the Testigos, 14th July, 1799, says "During a calm the current drew us on rapidly toward the west. Its velocity was three miles an hour, and increased as we approached the meridian of the Testigos, a heap of rocks which rise up amid the waters."

visible, the water flowed again to the eastward; and on the 11th, at six in the morning, with an observed latitude, and the said mountain bearing S.E. by S., we were in longitude $67^{\circ} 21'$; and this by calculation being $67^{\circ} 47'$, we found a difference of 26 miles to the eastward in sixteen hours. From this time till four in the afternoon, again 10 miles to the west; and from thence until the following morning 22 miles easterly difference. During the night we heve-to, to the southward of Caracas Bay, Curaçao, and were obliged to keep *Little Curaçao* in mind, as the current was strongly setting to the eastward.

"Whether this flux and reflux were caused by the moon (then new) or by any other agent, I shall not attempt to determine. Indisputably there occasionally appear satisfactory reasons for ascribing to that luminary some influence over the currents in these regions, and the above-mentioned case is probably one of them; but, as Captain Livingston says on this subject, 'the winds have a still more powerful influence.' Indeed, when roving in these seas, studying the *Memoir* and the *Colombian Navigator*, and enjoying the pleasure of reading all that science and skill have ever produced in the description of these regions, we always meet with Captain Livingston's remarks as so many illustrations, and feel a continued increase of respect for so accomplished a navigator.

"The reflux of the current to the eastward, for some hours daily, we had also occasion to observe, in January, 1834, near the coast of Hayti, Porto-Rico, and even in the Atlantic, while working up with smart breezes, and even with very strong winds; and once, in May, 1835, a merchant vessel, steering for Curaçao, with her main-mast broken, passed in the night to the southward of Buen-ayre and *Little Curaçao*, without seeing the land, being totally unacquainted with any existing current, and consequently with her real situation. At day-break, finding herself opposite the eastern part of Curaçao, and supposing it to be the Island of Buen-ayre, she stood to the west for Curaçao, as she thought, but on her passing the harbour of St. Anna, she guessed her error, and tried to gain the entrance, in which she succeeded toward sun-set, after hard struggling with a strong wind and a rough sea, but assisted by a current to the *eastward*.

"It should be borne in mind that the captain of this vessel was unprovided with a time-keeper, from want of which he knew nothing about easterly or westerly currents; and if, on his approaching Buen-ayre, he had accidentally stood a few miles to the N.W., so as to make its northern coast, he would have found a watery grave, designated, perhaps, only by some piece of floating timber, a splinter, or broken spar.

"The uninterrupted easterly currents, alluded to, have already been mentioned by Baron A. von Humboldt, and whenever I witnessed them, I found them just as described by that celebrated traveller. It may, however, be remarked that, although this change in the general motion of the water is most common in the three months quoted, and chiefly along the Colombian coast, yet sometimes it also happens in other months, and in other parts of the Caribbean Sea, as we, in fact, once experienced it in December, once in April, near the coast above mentioned, and once in March, on our passage from Guadeloupe to Barbadoes, during which, vessels from St. Vincent's made their way toward the same island in a few hours."

FURTHER DESCRIPTION, FROM THE JOURNALS OF BRITISH NAVIGATORS.

Mr. Town, in his *Directions for the Colombian coast*,* has said, "Although, between the Island of Jamaica and the Spanish Main, westerly currents are most frequent, yet they do not always prevail; for ships have been known to be driven by the current from 50 to 60 miles to the *eastward*, in four or five days. From the beginning of May till November (*the rainy season*), the sea-breeze seldom or never blows home to the main: and ships when there should never go to the southward of the latitude of 11° , until they are at least 40 or 50 miles to the westward of their intended port; after which they may make a south course, as the land breeze, which is generally from the S.W., and the strong *easterly* current, will set you to the eastward of your intended port, if great care be not taken. When to the eastward, if light winds prevail, you must stand to the northward until you meet the sea-breeze, which will be between the latitudes of 10 and 11 degrees, and then run to the westward.

"Being off Porto-Bello, in his Majesty's ship *Salisbury*, on or about the 12th of August, 1816, and being a little to the eastward of that port, with light variable winds for

* See the *Colombian Navigator*, vol. iii. p. 231.

several days, the ship was set to the *eastward*, at the rate of 50 miles per day ; and, having been afterwards placed in the same situation, I found it necessary to make the land well to the westward, and to keep close to it. From November until May (the *dry season*), you should endeavour to make the land well to the eastward, and run along shore ; as the sea-breezes generally blow very strongly, and the current sets to the westward at the rate of about two or three miles in an hour.

“ Between Chagre and Porto-Bello, during the rainy season, there is generally a northerly current, at the rate of from one and a half to two and a half miles an hour. After the end of the rainy season the current sets to the southward and westward, and strong southerly and easterly winds prevail here. From November until May (the *dry season*), the southerly and westerly are very light winds, except in squalls, which end with heavy rain. In sudden squalls, you will often have the winds from all points of the compass.

“ If at Chagre, at any time during the rainy season, (May till November,) and bound to the eastward, endeavour to get four or five leagues from the land, so soon as you can ; for the winds are, in general, very light, and the current very strong. The latter sets from Chagre directly on the rocks of Porto-Bello, and thence along the land from E. by N., E.N.E., E.S.E., and according as the land lies ; its general rate being from one and a half to two and a half miles in an hour. Great care should be taken when near the land, if a heavy squall and rain appear to be coming on. During this you will have the wind from all points of the compass, and often so strong that all sail must be taken in.

“ In crossing the Gulf of Darien, little or no current will be found ; whenever there is any, it sets about South, S. by W., or S. by E., up the Gulf.

“ Near Cartagena the current generally goes with the wind ; but off the Islands of Rosarito it sets to the N.W. and N.N.W., from one to two miles an hour.

“ Between Cartagena and the Magdalena, in the rainy season, you cannot put any dependence on the winds or currents ; but, from November to May, the trade-wind blows home.

“ I should recommend, if turning to windward, with strong trade-winds, to keep the shore close to : whereas, by going off from the land, you will not only have a heavy sea, but also a strong N.W. current. If you have light variable winds, approach no nearer to the land than 4 or 5 leagues, as you may be certain of an easterly current.”

Captain Livingston says, “ During five weeks in which I remained at *Cartagena*, in June and July, 1817, the current in-shore set constantly and strongly to the northward, at a rate, I am convinced, of not less than a mile and a half an hour, or nearly as strong as the Mississippi at New Orleans : I have seen the *Esk*, sloop of war, current-rode against a very fresh sea-breeze, when at anchor, nearly west from the city, distant about a mile.”

Upon the CURRENT between the GRAND CAYMAN and CAPE ANTONIO, Captain Monteath has said, “ In the months of May, 1814 and 1815, (two voyages in which I was chief-mate of the ship *Prince Regent*, from Kingston,) in June, 1817, in the ship *Fame* ; and in April and December, 1820, in the ship *Mary*, between Grand Cayman Island and Cape Antonio, I invariably found the current setting strong to the eastward, or E.S.E. ; and I have heard it generally remarked that, vessels shaping a course from the Caymans for Cape Antonio, have found themselves off, or even to the eastward of, Cape Corrientes : this has, in the above cases, invariably happened to myself.”

Farther on, “ In my passage from Kingston, toward Campeché, in the ship *Fame*, June, 1817, between Cape Antonio and Cape Catoche, I found the current to set due *North*, 27 miles in a run of 18 hours.”

We have already given, in a preceding page, the remarks of the Spanish navigators on the currents of the Mosquito Shore and Bay of Honduras. We now add those of our friends Captains W. J. Capes, of London, and John Burnett, of Port Glasgow.

Captain Capes says,* “ Between JAMAICA and BONACCA the current generally sets to the northward and westward. Here, in May, 1816, I was set 60 miles to the westward by the current, and found that it set rather northerly, from one-quarter to half a mile an hour.

* Capt. Capes, since deceased, was one of those kind and generous individuals who delight in promoting their own happiness by contributing to that of their fellow beings. Honoured be his memory !—J. P.

Between Jamaica and Bonacca are the islands called the Swan Islands, in latitude $17^{\circ} 24'$, long. $83^{\circ} 52'$. I would not advise any one bound to the Bay to make these islands, for it cannot be of service, and the current is so very irregular about them, that the attempt serves only to bewilder the navigator; and by falling in with them in a dark night, a ship would be in danger of running on shore, as the land is very low.

"About the SOUTHERN FOUR KAYS the currents are very uncertain. I have known three ships to be lost on these Kays by lying-to for the night, after they have made them; for, at all times, the currents set strongly on them; and, in two of the cases, the ships were every two hours, with an intention to keep their station. In one voyage I took my departure from Bonacca, at four *p.m.*, with a strong breeze from the east, which continued till midnight; it then died away, (no uncommon circumstance in this part,) so that I did not lift the Southern Four Kays before 4 *p.m.* the next day, from the fore-yard. I then made all snug, and plied to windward, under single-reefed topsails and topgallant sails over them; tacked ship every three hours, during night, and, to my surprise, in the morning, we were not more than one or two miles to the windward of them; so, if I had hove the ship to, I have no doubt but she would have been driven on shore by the current.

"If a ship be lying-to, under RATTAN, it will not be amiss to try the current. It is my opinion that the current about Bonacca takes two different directions; one part setting to the N.W., and the other part branching to the S.S.W. I have found it so on several trials, which is the reason that I prefer taking a departure (for the Bay) from the middle or East end of Rattan: for, if a ship take her departure from the West end, her course will be N.N.W.; but it very frequently happens that ships get down on those reefs when they take their departure from the West end. The reason is this: a ship steering N.W. from the West end has more of the current on her beam, which sweeps round the West end of Rattan, very strong at times; consequently, ships that take their departure from the East or middle part do not feel so much of the current."

Captain Burnett, in his directions for sailing from the BAY of HONDURAS, says, "When the trade-wind prevails, a current, often very strong, sets down between Mauger Kay and the Northern Triangle; there, dividing itself, it sets to the southward, between Turneff and the main Reef, and to the northward between the triangle Reef and Ambergris Kay. It is most adviseable, with the wind from East to E.S.E., to sail to leeward of the Triangle, as you will have a strong current in your favour so soon as you bring it to the eastward of you.

"In the channel, between the island Cosumel and the shore, the current along shore runs at the rate of nearly $2\frac{1}{2}$ miles an hour, till lost in the Mexican Sea."

MEXICAN STREAM, &c.—It is, we believe, a well-established, although a controverted, fact, that there is a constant indraught on the *western* side of the CHANNEL of YUCATAN, into the Mexican Sea; and that there is commonly a reflow on the *eastern* side of the same channel, around Cape Antonio, &c.

With the former in its favour, his Majesty's ship *Resistance*, Captain Adam, off the Bank of Yucatan, made a course W.N.W. $\frac{1}{2}$ W. nearly 80 leagues in the 24 hours, December 16 and 17, 1806;* and we have no doubt that many instances may be found to prove the same effect; on the Cuba side only, it appears that vessels have been set to the southward; and Captain Manderson has stated that, when a strong easterly wind has been blowing between Cuba and Florida, vessels heaving-to off the South side of Cape Antonio, at about two leagues from shore, have, in the course of one night, been carried against a strong sea-breeze, nearly as high as Cape Corrientes, being a distance of 10 leagues.†

* The northernmost part of the track extended to $24^{\circ} 50' N.$, in longitude $90^{\circ} 39'$.

In the ship *George IV.*, 14th March, 1824, Captain Hamlin found the inset into the Mexican Sea, along the coast of Yucatan, N.E. 42 miles in the 24 hours. Lat. at noon, $19^{\circ} 24'$, long. $87^{\circ} 7'$. On the next day, it set toward Campeché Bank, northerly 50 miles.

In the brig *Recovery*, 5th Sept. 1822, the same commander found the current on the N.E. side of the Yucatan or Campeché Bank setting about a mile and a half to the northward. Next day, on proceeding toward the Mississippi, weather calm and very sultry; at 5 *p.m.* saw two very large waterspouts to the N.W. At 7 h. 30 m. a smart squall came on suddenly. At 8, cleared up; light winds with much lightning. At 10, next morning, severe squalls, which split the main top-gallant sail and boom mainsail. Lat. at noon, $25^{\circ} 42'$, long. $86^{\circ} 53'$.

† Our friend Captain Rowland Bourke, when once lying-to for the night, off Cape Antonio, found himself next morning, off Cape Corrientes.

The ship *Carshalton Park*, Captain J. Steele Park, sailed from Jamaica for London, on the 20th of May, 1824. At noon on the 27th she was off the S.W. side of Cuba, in latitude $21^{\circ} 26'$, longitude by chronometer and lunars, $84^{\circ} 47' W$: Here was discovered a current setting to the N.W. at the rate of two miles an hour. At 7h. 30m. Cape Antonio bore N.W. 5 or 6 miles. "The current to the N.W." says Capt. Park, "swept us into the Gulf of Mexico; and there we were beating about, three or four days, making nothing and westing in spite of our teeth. All this time the wind was easterly, and we might have cruised about there till Christmas, had the wind not got a little to the southward of east, which enabled us to get over to the N.E. side, where we found the current running directly opposite to the former," being now in the Florida-stream.

From CAPE ANTONIO the current sets, at times, to the E.S.E., past the Isle of Pines. Captain Livingston has informed us that, in March, 1818, he found the current between the Great Cayman and Isle of Pines to set in that direction, at the rate of fully two miles and a half in an hour, or 60 miles in the 24 hours. In August, 1817, he found the set nearly the same, but the current not half so strong. The Spanish Directory says, "From Cape de Cruz, on the South side of Cuba, it is noticed that there is a *constant current to the westward*, with some inclination to the southward or northward, and which has been known sometimes to set 20 miles in a single day." In opposition to this, the exact words of Captain Livingston are, "I have twice experienced a strong current, setting about E.S.E., between the Caymans and Isle of Pines; and, on the latter of these occasions, both my mate and myself separately calculated it to set about 60 miles per day, or $2\frac{1}{2}$ per hour. This, however, I incline to think a very particular case, such as may but seldom occur. The winds at this time were light and westerly. On the other occasion, so far as I recollect, it set about 12 or 14 miles per day only. All my papers on these subjects have been lost; but the first instance was too remarkable to be forgotten."

On the northern coast of Hayti, and in the Windward Passages, there does not appear to be any general current. On the north side of Cuba, the case is nearly the same; but in the channel here is a regular tide throughout the year, subject, however, to certain variations.

The currents of the Caribbean Sea appear to be varied by the influence of the moon and change of seasons, and combine, in some degree, with the tides; especially about Cuba, Jamaica, and Hayti.

Off the south side of Cuba the current has frequently been found setting to the eastward when the moon is increasing, or in her first two quarters, and thus it continues from Cape Antonio to Cape Maize. It is represented that it runs to the eastward for a fortnight, and then to the westward about the same time. Coasters from the Caymans commonly take the advantage of the easterly current for making their passages to Jamaica.

From this information we may conjecture that the current, which has been described as setting to the E.S.E. from Cape Antonio, is not *permanent*, but, at times, on the contrary, imperceptible, according to the age of the moon; and this has, we believe, been verified, in several instances, while the cause has remained unknown.

Mr. Dunsterville has said, "I am firmly established in an opinion, from twelve years' observation, that not only are the winds and weather, on the West-India station, influenced by the changes of the moon, but the currents also; and it is frequently found that, if the waters run to the eastward, it is at the change and full of the moon."

In an old book, already noticed, (Kelly's Navigation, Vol. I. 1733,) is an abstract from a journal, which contains the following passage:—"Between the West end of Hispaniola and the island of Jamaica, if I took my departure upon a full or change of the moon, I found that I made many leagues more than I did at the quarters of the moon. At the full and change, I was looking out for the land long before I saw it; and, at the quarters, I was down upon it long before I looked for it. The reasons as I found afterward, were, that the full and change made a strong windward current, and the contrary on the quarters. This has been exemplified in many instances."

On this subject Captain Livingston says, "It is a prevailing opinion with many, that the moon governs entirely the currents among the West-India Islands. No doubt the moon has some effect on them, but the winds have a still more powerful influence.

"It is rarely, indeed, on the North side of the island of Jamaica that there is a westerly current when the North and N.W. winds prevail; the current then always, or almost always, setting to the eastward.

"On

"On the South side of Cuba, when the wind is westerly, which it often is, you are always certain of a re-flowing current round Cape Antonio. This is easily accounted for; as when the fresh trade-wind ceases, and the westerly winds set in, the barrier is, in some degree, removed which confined the waters in the Mexican Sea, and they seek to regain their level as well by the Channel of Yucatan as by the Strait of Florida."

Between the Isle of Pines and main land of Cuba is a strong north-easterly indraught, generally running from one to one and a half mile an hour, and which has caused the loss of many vessels on St. Philip's Kays and the dangerous bank stretching therefrom to the westward.

In the Windward Channel of Jamaica the current generally sets with the wind to leeward or S.W.; yet both here and at Jamaica, it is variable. Some have affirmed that, when a current runs to leeward, on the South side of Jamaica, there is frequently one setting eastward on the North side; and, at other times, no current is to be perceived; also that, when a lee-current runs on the North shore, the same circumstances may be perceived on the South shore as were before observed on the North.

But between the Mona Passage and the Caymans, South of the islands, the tendency of the currents toward shore is most commonly found to be to the north-westward.

In the Bahama Passages the currents are devious; both weather and lee-currents having been found. These, also, appear to be influenced by the tidal causes; for the tides are operative on the banks, and sometimes set strongly.

CURRENTS in the vicinity of the CAYCOS.—Some years ago, a British frigate, on returning from the northward, and shaping a course for Turk's Islands Passage, made that of the Caycos, and was not undeceived until the Porpoise head showed itself at the long reef of the N.W. point of Providence Cayco, which appeared 3 or 4 points on the starboard bow. Again, shaping a course, in hazy weather, from Inagua for Castle Isle, the south point of the Crooked Islands, she came upon the Mira-por-vos, and did not discover the error until the rocks were seen under the ship's bottom; passed to the S.W. of these kays, distant half a mile, sounded in $\frac{1}{2}$ 9, 10, $\frac{1}{2}$ 10, and 11 fathoms, sharp coral rock. "Through a thick haze, Castle Isle was not seen. There is a rock, among the Mira-por-vos, which shows much like that of Castle Isle, and it was this rock which served to deceive the master. When this rock bears N.E. by E. $\frac{1}{4}$ E., two miles, only two of the kays are seen to the westward of it."

On the 13th of September, 1833, H.M.S. *Dispatch* sailed from Port Royal, Jamaica, for Barbadoes. Having cleared Morant Point, steered for Navaza, but the winds falling light during the night, the current setting to the N.W., carried the vessel well to the westward of it. The wind still continuing light, she had some difficulty in stemming the current, which makes about S.W. by W. between Cape St. Nicolas Mole and Cape Maize; and it was not until the 23rd that she weathered Tortue or Tortuga. The wind being still light, and from the eastward, it was determined to make the Mariguana instead of the Turk's Islands Passage.

At day-light on the 24th saw the S.E. point of Great Inagua, bearing N.W. by N.: when first seen on this bearing, it had, on the east side, the appearance of a low flat; there being a range of hillocks on its south side, it there made like a groupe of small islands: the northern visible extremity terminated in a rising ground gradually sloping from its summit, which lies about one-third up the east side or seven miles from the S.E. point. Saw the reef on which the *Statira* was lost, in 1815. At noon tacked in 13 fathoms, rock, about three miles off shore, with the S.E. point S.W. and N.E. point N. by W. Little Inagua, just visible from the topsail yards, off the N.E. point. The coast here is fringed by a line of rocks, in many places showing above the water, with a clear space of half a mile between them and the beach. At one, tacked; at four, opened the north side of Great Inagua off the N.E. point, it bearing at the time W.S.W.; eastern extremity of Little Inagua N.N.E. At 5 h. 30 m. tacked, with the N.E. point of Great Inagua south; extremity of Little Inagua from N.E. by E. to W. by S. As we stood along the south side of Little Inagua to the east it appeared fringed by a reef similar to the greater isle: the east part was quite white from the dung of birds, so as to be clearly distinguished after the other part of the island could no longer be seen.

September 25, at 2 a. m. tacked, and at day-light made the West or Little Cayco, N. by E. two miles; stood along its western side at about one mile off shore, and found it quite clear: off its S.W. end is an appearance of foul ground, caused by the current which sets over the bank

bank from the eastward meeting that which sets to the S.S.W. along shore; the ripple and collection of weed from the bank give it the appearance of a reef. At 2 h. 50 m. *p. m.* saw Mariguana, bearing N.N.W.; and at four, the breakers on the reef which extends from its eastern end. The chronometers gave the east end of the reef in $72^{\circ} 36'$. The reef extends at least five miles from the land, and terminates in a patch of rock above water, in the centre of which stands a single stone, like the broken shaft of a pillar, about 20 feet above the rest. The ground appears quite clear close to the reef, and no bottom with 50 fathoms within half a mile of its southern edge.

At 5 h. 30 m. *p. m.* tacked and stood along the south side of the reef; and at day-light on the 26th saw the northern extremity of the Caycos, bearing S.E. by E.*

THE FOLLOWING is an additional DETAIL of the best information we have been able to collect, of the Currents in the Caribbean and Mexican Seas, from the *Derrotero de las Antillas*, &c.

In the Channel between *Trinidad* and *Granada* the current has been found to set nearly West; on the South side half a point southerly, and on the North side half a point northerly. Its velocity from a mile to a mile and a half and two miles per hour.

Between *Granada* and *St. Vincent's*, among the *Granadines*, the currents are devious; but the general inset appears to be W. by N.

Between *St. Vincent's* and *St. Lucia* the current, from the eastward, sets in more northerly; and within, on the West, it has been found setting to the N.W. Between these islands it seems to be as strong as in any other part of the range.

Between *St. Lucia* and *Martinique* it has been found nearly North. Very variable on the western side of the latter.

The current sets nearly in the same manner between *Martinique* and *Dominica*. Northward of *Guadaloupe* it set W. $\frac{1}{2}$ S., and between *Montserrat* and *Antigua*, N.W.

At the distance of about one degree, within the range of the *Caribbee Islands*, and to the *Virgin Islands*, the current has been found setting, in general, to the W.N.W., from one mile to one mile and a half an hour.†

In the *Mona Passage*, between *Porto-Rico* and *Hayti*, the current has been marked as frequently setting to the N.W., and we have instances of a set through to the S.W., but Captain Monteath, in February, 1816, when proceeding southward toward *Porto-Rico*, in from latitude $23\frac{1}{2}^{\circ}$ to 22° , and longitude 64° to 65° , found the current setting N.N.E. at the rate of 20 miles in the 24 hours: and he says that, off the N.W. end of *Porto-Rico*, it invariably set from the *Caribbean Sea* to the North and N.N.E. On the western side of the *Passage* it set North, 2 miles an hour: but there have been instances of an inset from the N.W.

From *Trinidad*, westward, and off the North side of the *Spanish Leeward Isles*, the current has been found setting West and S.W. to the *Gulf of Maracaybo*; thence S.W. also to *Cartagena*: but it varies, as already described.

From *Cartagena* toward the Channel of *Yucatan*, it has been found N.N.W., N.W. W.N.W., and N.W. by N., from 1 to nearly 2 miles, and then decreasing to $1\frac{1}{2}$ mile per hour. It has also been found setting to the eastward, as shown in the preceding pages.

THE CURRENTS in the BAY of GUATEMALA, between *Cape de la Vela* and *Cape Gracias a Dios*, have been ably investigated by Captain Wm. Sidney Smith, R.N., as shown in the 'Colombian Navigator,' vol. iii. pages 245, 6.

BOTTLE EXPERIMENTS.—*Caribbean Sea to Yucatan*. A bottle from H.M.S. *Chanticleer*, in latitude $15^{\circ} 29'$, longitude $76^{\circ} 3'$, at noon on the 23d of February, 1831, (the ship being to the southward of *Jamaica*), was picked up on the 20th of the next April, upon the eastern coast of *Yucatan*, after having traversed over a distance of nearly 700 miles.

* Extracted from 'Notes' by Capt. G. Daniell, R.N., on a passage from Port Royal to Barbadoes and Anguilla, and thence to Maranham and Para.—*Nautical Magazine*, Dec. 1835.

† On the leeward side of the *Virgin Isles*, devious currents are found, frequently to the south-eastward. The same have been observed on the western side of *St. Christopher's*, &c., but see, hereafter, the particular directions for navigating among the *Windward Islands*.

SERRANILLA to YUCATAN.—A bottle from a boat belonging to H.M. surveying ship *Thunder*, at anchor under Serranilla West Kay, 10th of March, 1834; picked up at Half-moon Kay, in the Bay of Honduras, on the 23rd of the next month, April.

TOBAGO to the CAYMAN.—A bottle from the American brig *Emma*, on her way from Philadelphia to Berbice, 17th June, 1838, in latitude $11^{\circ} 4'$, long. $58^{\circ} 50'$; picked up on the 27th of the following August, upon the eastern shore of the Grand Cayman.

WINDWARD CHANNEL, between Jamaica and Hayti. A bottle from H.M.S. *Thunder*, in lat. $18^{\circ} 56'$, long. $74^{\circ} 56'$, 7th of February, 1839; current then setting S.W. by S. half a knot: picked up in the Grand Anse, near Jeremie, (long. $74^{\circ} 1'$) on the 24th of the same month.

HAYTI to FLORIDA.—A bottle, some years ago, from the ship *Robert*, Capt. Coulter, eastward of Alto-vela, on the south coast of Hayti, picked up about thirteen months afterward on the shore, near St. Mary's, in Florida.

At about 40 miles northward of *Cape Catoche*, the current has been found N.W. by W.; changing thence to S.S.W. off the N.W. point of Yucatan, nearly at the same distance from the coast. Rate something less than half a mile an hour. *Between this and Vera Cruz the current ceases.*

Three degrees to the N.N.E. of Vera Cruz, the current has been found setting to the N.E. one mile an hour. Thence N.N.E. and N. by E., and again N.E. nearly to the parallel of $25\frac{1}{2}^{\circ}$, longitude $91\frac{1}{2}^{\circ}$. Here it changed more to the East, and became, in latitude 26° , E. by S., changing southward to the S.E. by S. in the direction of the River Missisipi, and latitude $25^{\circ} 30' N$. Hence it sets, with some variations, toward the western end of Cuba.*

On a passage between Vera Cruz and Havana, 10th to 22nd April, 1828, Lieut. Jn. Evans informs us that little or no current was perceptible.

On the 17th, at noon, in the Mexican Sea, the vessel was in lat. $26^{\circ} 52'$, long. $89^{\circ} 17'$. On this day *fucus natans*, or gulf weed, was seen, in parallel lines, S.S.E. and N.N.W. It was in flower,† and completely covered with young barnacles. "From the latitude 25° to 28° in this sea, we met with the fucus in parallel lines, S.S.E. and N.N.W.: it flowers like fern and other *cryptogamia*." In calms the fuci float near the surface, some of the leaves appearing above water; the patches seen in the Florida Stream, and the bunches examined, were old, brown, and covered with young barnacles.

The phosphorescent lights observed in the Mexican Sea, shine with greater brilliancy (April) than I had noticed them elsewhere: some of these were very large, and flashed like the priming of a gun, sometimes at a long distance from the ship. I observed that, the little shining spiracles were confined to the sides of the vessel and her wake, and that the waves, when they broke into foam, did not (as in other parts of the ocean) sparkle.

The colour of the water in the Sea of Mexico is of a dark indigo, darker or more intense than that of the ocean generally: the colour of the sea in the Florida Channel is a fine blue, not so dark as that of the Sea of Mexico, or of the ocean generally. Phosphorescent lights are equally abundant in the Florida Stream, some unusually large and brilliant; and some of the small lights appeared to spring out of the water, with a sweeping motion, which I had never before observed; the temperature of the water was 79° , that of the air 76° .—J. E.

The current in the Gulf, from Vera Cruz to the meridian of the Missisipi, is noticed above. We have shown that it commonly sets S.E. by S. in the direction of the River Missisipi, and latitude $25^{\circ} 30'$. The current hence sets variously to the south-eastward. Its extent and exact direction are unknown; but it is certain that, setting toward the N.W. of Cuba, and striking on the Banks of Isabella and Colorados, a portion of it winds round Cape Antonio to the south-eastward, while the great body of it sets eastward, to the northward of Cuba, winding to the E.N.E., N.E., and North, through the Strait of Florida,

* Experience confutes the generally received notion, that the water circulates around the Gulf from Yucatan to Florida.

† This weed is described in the description of the *Sargasso Sea* hereafter. It has already been noticed in page 181.

and into the Atlantic Ocean, under the denomination of the **FLORIDA OR GULF STREAM**, as shown on the Chart.*

7. The **FLORIDA** or **GULF** **STREAM**.

This wonderful *Current* originates, as we have already shown, from the superior level of the waters of the Colombian and Mexican Seas; and, like an immense river, it wends its course eastward between Cuba and Florida; northward between Florida and the Bahamas, occupying nearly the whole breadth of the channel; and thence setting nearly parallel to the American coast, in a N.N.E., N.E., and easterly, direction; until, gradually losing its impetus, it falls to the *southward* on the meridians to the west of the Azores or Western Islands, and is finally lost in the *Sargasso* or *Weedy Sea*. (See page 181.) These are its general limits as to length, which may be estimated at more than 3000 nautic miles from the Mexican Sea; but it is well known that, overflowing, its waters have, at times, extended eastward beyond the Azores, and even to the coast of Portugal and Bay of Biscay.

With regard to *breadth* we shall, at present, observe only that its narrowest part is in the Strait of Florida, between the point named *Cape Florida* on the west, and the *Great Bank of Bahama* on the east; a distance of 35 or 36 miles. The stream occupies nearly the whole breadth of this channel, and here sets with great velocity: off Cape Hatteras, about 700 miles more to the northward, its breadth is computed as, generally, about 75 miles; but it soon after expands, to an indefinite extent, northward and eastward, as will be shown hereafter.

The latter part of the month of August and beginning of *September* is the period in which the Gulf Stream runs in its greatest strength and highest temperature. Its weakest and lowest is in February. Its greatest velocity is, at all times, in the narrows between the *Bemini Isles* and *Cape Florida*. Here, in August, it has been found to run more than 100 miles in the 24 hours; while, at a distance westward, it has not exceeded 70 miles, and northward about 80. In October the stream is considerably weaker; and it fluctuates, in all seasons, according to circumstances. The border of the stream, near the Cuba shore, is generally weak; and here, at times, is even a *counter current*, running westward. On the meridian of Matanzas, the greatest velocity of the stream is on or near the parallel of 24°. The strength of its western and northern borders, in its entire and vast extent, is much greater than those on the east and south, which have invariably a tendency to spread over the ocean in whirls or eddies, and which are, therefore, comparatively weak.

The high temperature of the stream in the incipient portion of its course varies from 87 to 84 and 83 degrees; and this temperature decreases so slowly, that, by affecting the cold atmosphere of the N.E. region, it contributes to those storms which have been so frequent between the parallels of Newfoundland and the Bermudas.†

It has heretofore been said that the stream itself was moved by the wind, but from its vast depth and volume it is now held that this is impossible, and that the wind affects the *surface* only, although the borders or edges may be forced by it over the adjacent sea, or the edge of the sea over the stream; either cause producing the same appearances on the surface.

The current from the Mexican Sea, before entering the Strait, runs at the rate of about a mile and a half in the hour. After entering, it increases to 2½, 3, and occasionally 3½, miles. On being compressed in the narrows, between Cape Florida and the Beminis, it

* At about 3½ degrees North of Cape Antonio the current has, at times, been found setting to the S.W., winding toward the northern edge of the Yucatan Bank; but, at a degree thence eastward, setting nearly S.E. Off the West end of Cuba, at half a degree N.W. from Cape St. Antonio, it has been found setting S.W. by W. one mile an hour. But these cannot be considered as its *general directions*.

On the southern edge of the Tortugas Soundings, June 23 and 24, 1820, lat. 24° 30', long. 83° 30', Captain Monteath found the current setting E. by S. 20 miles in the 24 hours. Passing next day to lat. 24°, long. 82° 20', it was found to have set E. by N. 42 miles.

† For the use of those advancing westward, we have, in the first volume of the '*Colombian Navigator*,' taken a view of the Stream *inversely*; dividing it into four sections, beginning with the East, and including in each the temperatures, &c., as found in the different seasons. Other particulars will be found to accord with the present description.

has been found to run five miles at the *maximum*, in August, and seldom below four throughout the rest of the Strait; and thence to latitude 31° , $3\frac{1}{2}$ miles. This must be understood to mean the central and strongest part of the stream.*

On the Cuba side, as above mentioned, the stream is weak, and it sets to the eastward.† On the opposite side, along the Florida Reefs and Kays, there is a re-flow or counter-current, setting to the S.W. and West. By the assistance of the latter, many small vessels have navigated through the Strait from the northward; but this navigation is too dangerous to be attempted by strangers. The tides set among these reefs, as shown in the preceding division of this work.

The winds are found to affect the position of the surface considerably. Between Cuba and Florida, northerly winds press it southward toward the shore of the former; southerly winds have a contrary effect. When turned to the north, easterly winds press it to the Florida side, and westerly winds nearer to the Bahamas. Southerly winds cause it to spread, and so may those from the north.

In the Strait of Florida, within the Bahamas, when a northerly gale, increased to a storm, opposes the stream in its course, this adverse power causes it to fill all the channels and openings amongst the Martyr Isles and Reefs, and to overflow all the low coast. Shipping have even been carried over the low kays, and left dry on shore.‡ The water is supposed, at times, to have risen to the height of 30 feet; and to have been running, against the fury of the winds, at the rate of seven miles an hour. During these times, the Strait of Florida exhibits a scene terrific beyond description.

Beside the effect which different winds have upon the stream, it is subject to another power, that also directs it toward or from the coast; and that is, the moon; which, according to her position, has different effects upon it, not, however, in equal power with those of the wind; but the disposition of the stream is increased to its extreme, if the effect of both the wind and moon are combined; for, at this time, the ocean rising highest, this regulates the flood and ebb, and divides them in proportionate times; consequently it directs and increases them with an easterly moon and wind to the west, and with a westerly moon and wind to the east; so that the west and east shores are at times deprived of, and at other times overflowed by, tides, occasioned by these vicissitudes.

* "The calculations of the velocity of the Gulf-stream are not to be depended on. I have found it setting at the rate of five knots, and even upwards. This was on the 16th and 17th August, 1817. On the 19th and 20th of February, 1819, it seemed to be almost imperceptible. In September, 1819, it set at much about the rate described in the Charts."—*Andr. Livingston*.

† What seems anomalous is, that the stream, along the north coast of Cuba, sets, at times, to the westward; probably all the way from the Bahama Old Channel. Of this we have several instances, from the communications of Captain Livingston and others; the most singular of these, however, is that of Captain London, of the brig *Peru*, on returning, in the latter part of November, 1827, from New Orleans to Liverpool. Captain L. had made the *Iron Hills* in Cuba: shortly after noon he tacked ship to the northward and westward, about 8 or 9 miles off shore: next day he kept beating to windward, as near to the middle of the Strait as he could judge, and without sighting the land on either side, the wind then blowing a fresh gale from the northward; and he continued beating in the same manner until about 8 a.m. of the second day, when, by *reckoning*, he ought to have been near the Salt Kays: but obtaining a lunar observation, it showed, to his astonishment, his longitude to be to the westward of 83° . Supposing his observation to be erroneous, he took a second set of lunar distances, which gave a similar result. Still, however, doubtful, he stood on, and in a short time afterward gained soundings on the *Tortugas Bank*! The northerly gale had now abated, and he worked his vessel in, on soundings, to the northward of the Dry Tortugas. With a favouring wind he ran through the Tortugas Channel, but as light and baffling winds succeeded, he made for the stream as it became dusk, and with such winds got through the Strait in the two following days; having, on his way, found the current very rapid along the Martyrs.

Captain London justly remarked, that so extraordinary a circumstance, of which he is *positively certain*, ought to be generally known.

"Masters of vessels from Vera Cruz, &c. to Havanna, often lengthen their voyage by keeping away too much to the southward after rounding the Dry Tortugas, fearful of being carried away to the eastward of Havanna by the strength of the Florida Stream! Some have fetched in about the port of Honda, the Cock's Comb, and one vessel even as low as Cape Antonio!"—*Lieut. Jn. Evans*.

‡ In the month of September, 1769, there happened an inundation, which covered the tops of the highest trees on the Cayo Larga, &c., and during which the Ledbury snow, John Lorain, master, was carried over the reef by the N.W. current of the stream, caused by a gale from N.E. The vessel bilged in shallow water, but an anchor was thrown out, and the next day the vessel was found to have grounded on Elliot's Kay, with its anchor among the trees.—*De Brahm's Atlantic Pilot*.

The boisterous East, N.E., and North, winds, which affect the Gulf-Stream, generally begin in September, and continue until March; when, if the moon happens just at the time to be on the full or change, they commonly end with a hurricane.

The stream, from latitude 26° to 28° , generally sets North, rather easterly. Between the parallels of 28° and 35° (or that of Cape Hatteras) it has a North, N.N.E., and N.E., direction. On the west it is bounded by the banks extending from the American shore, nearly parallel to which it runs, at varying rates, according to the season. The nearest edge of the stream, from the coasts of Georgia and Carolina, is about 40 miles; but it approaches nearer to that of Florida. The average breadth of the stream itself may be about 60 miles; less near Cape Canaveral, and more near Cape Hatteras. As it is supposed to fall down a steeply inclined plane at its exit from the Strait, its velocity here is the greatest, and has, at times, been found at the rate of five miles an hour; but the average rate of the whole is about three miles.

"In the month of July, 1813, the fleet of merchant vessels from Jamaica, under convoy in the Strait, from the 9th to the 14th, after passing the Double-headed Shot Kays, was becalmed, and the current swept the whole through the strait by its strength alone. By calculation it appeared to have run 60 miles in the 24 hours; or $2\frac{1}{2}$ knots an hour. On the 15th the convoy was on the parallel of 27° North, with a fresh W.S.W. breeze: current N.N.E. In the following year circumstances precisely similar occurred, in the same season; and the fleet was carried through the Strait without a breath of wind."—(*Colombian Navigator*, Vol. I., p. 216.)

The stream, instead of leaving the neighbourhood of the coast at Cape Hatteras, as formerly described, has been found to range up to the parallels of 38 and 39 degrees, running at the rate of about $2\frac{1}{2}$ knots: then George's and the Nantucket Banks appear to front it, and to throw it off to the E.N.E. and E. by N. northerly.

After passing Cape Hatteras, the western border of the Stream ranges from N.N.E. to N.E., and thence bends eastward over the edge of George's Bank, &c., in or about the parallel of 40° N. Its southern border, in a N.E. and E.N.E. direction, crosses the parallel of 35° N. in about longitude 73° W., or 120 miles E. by S. from Cape Hatteras. Within this border, the temperature, in the month of September, has been found as high as 83° , and even in December, as high as 74° . In the central parts of the Stream, westward of longitude 70° , in the month of October, the temperatures have been found to vary from 64° to 70° , while those of the air and ocean, without the stream, have been nearly equal.

Between the meridians of Cape Hatteras and 60 degrees W. near the northern edge, in $39\frac{1}{4}^{\circ}$ N., temperatures of 62° have been found in February and April; but, in the latter month, near the centre, or latitude 37° N., 66° have been found, and 70 at half a degree more to the south. In May, near the centre, 60° to 65° have been found. In June and July, 66° to 72° . In August, 77° to 80° , lat. $37^{\circ} 20'$, long. 70° . In September, near the northern edge, 71° to 74° , and near the southern border 83° , as above-mentioned. In October we find the temperatures reduced, 70° to 64° ; but in the middle of the stream, even in November, (lat. 38°) 71° have been found.

It has been before observed, but here it may be repeated, that the fluctuations or changes of the stream within itself are, however, so great that no precise temperature can be given for any particular time. If we take a section of the stream in a S.S.E. direction from New York Harbour, we may find, on soundings before entering the stream, in April, a temperature of 41° or 42° : on the parallel of 38° , (100 miles farther out,) 62° : thence again, only 54° , increasing southward to 70° , and again diminishing to 68° and 64° , where a counter current of warm water from the stream has been found. The variations of temperature within the stream, have given rise to the conjecture, that veins of colder water, from the West, mix occasionally with the main stream. The average velocity, in the strength of the stream, exceeds 40 miles per day.

On the Bank of Soundings, between the Gulf-Stream and the coast, a breadth of about 40 miles, cold counter-currents are commonly found, setting in a S. by W. direction; more particularly in the winter months, December and April, at the rate of about half a knot, or 12 miles in the day of 24 hours.

Stream between the meridians of 70° and 65° W.—Between these meridians the northern edge of the stream appears as if limited by the edge of George's Bank, passing which it pursues a more northerly course, or nearly N.E. by E. to the meridian of 65° , which, in summer,

summer, it crosses above the latitude of 41° , but, in winter, considerably more to the southward.

The *southern edge* of the stream, in the same season, is found in about latitude $35\frac{1}{2}^{\circ}$.

The greatest strength of the stream, in August and September, is in about latitude $37^{\circ} 45'$, where the temperatures have been found to vary from 79° to 82° . In September, near the northern edge, 68° to 72° have been found. In March, from 44° near the northern edge, and 72° in mid-stream. In June, from 65° , on the northern edge, to 77° in the mid-stream. The velocities vary materially, even in the same month, but the average appears to exceed 30 miles per day.

Stream between the meridians of 65° and 60° .—This portion of the stream intervenes between the Bermudas and Nova-Scotia, and it has consequently been more examined than the tracks to the eastward and westward. In summer, its northern edge has been found in longitude 65° , on the parallel of $41^{\circ} 20'$; and, in longitude 60° , as already noticed, in $42^{\circ} 15'$. Its southern border is indefinite, for we find warm water, in a *counter-current*, running W.S.W. in $35^{\circ} 45'$, with intermediate southerly offsets from the main stream.

The Temperatures.—In the spring of the year the temperatures of this region are occasionally disturbed by the presence of ices, which cool the water to a great extent around. Hence we find that, in March, the water has been cooled down to 44° , while in mid-stream, in latitude $38^{\circ} 40'$, it has been at 71° . In August and September, in the mid-stream, 80° and 81° have been found near the parallel of 38° , with a velocity of more than two miles per hour. In October and November, 76° to 78° . In December, 68° to 71° . In February, 59° to 64° . In May, without the northern border, in lat. $41^{\circ} 10'$, 44° ; and within that border, in $40^{\circ} 55'$, 60° ; in $40^{\circ} 35'$, 68° to $69\frac{1}{2}^{\circ}$. In July, 70° to 81° . The last temperature was found in lat. $39^{\circ} 45'$, long. $62^{\circ} 35'$, but here, commonly, in the month of May, it does not exceed 69 degrees. The general direction of the stream, between longitude 65° and longitude 60° , is E.N.E., and its daily velocity varies from 50 to 20 miles. It was within this limit, and near the parallel of 38° , that the ship *New York*, Captain Bennett, experienced the dreadful storm, in April, 1827, which is described in pages 134 to 136. Temperature of the air at the time, 48° ; of the water, 74° !

The strongest part of the current prevails chiefly between latitudes $37\frac{1}{2}^{\circ}$ and 40° ; long. 63° and $65\frac{1}{2}^{\circ}$, and more particularly at about $38\frac{3}{4}^{\circ}$, in longitude 64° . Between the southern side of the stream and the Bermudas the currents are variable, but set, as well as on the north side, mostly to the west.

The following Remarks on the Stream were made by Sir Philip Broke, on the approach of winter, in October and November, 1811.

"During six weeks in October and November, 1811; three weeks within its influence, either crossing it between the parallels of $38^{\circ} 30'$ and $40^{\circ} 30'$, and longitude 60° to 63° by observation. Mostly continued blowing weather from N.W., S.W., or South. The current, irregular in velocity, but constantly to the E.S.E.: never less than 25 or 30 miles, and several times 50, in the 24 hours: always seen by *gulf-weed*.

"My chronometer was, at first, very correct, as we had opportunities of ascertaining by lunar observations: but I soon found, both from our own observations and the report of my brother officers, that the best chronometers became irregular in the heavy warm dump air over the stream; the thermometer standing at summer heat, and once at 80° , whilst it stood near the freezing point beyond its borders, as well to the south as the north.

"When the wind opposed the current, the sea was always heavy and broken, so as to occasion the ship to labour much under any trim of sail whatever."

These observations were confirmed in after cruises.

Sir Philip adds, "Those who have no reason for navigating in this stream, should always avoid it in the winter season; as the sea which then prevails is unusually heavy and irregular; the climate warm, squally, wet, and unsettled. During S.W. or West gales the air is sultry hot, even in the winter; and in the latitudes of 39° and 40° , when just beyond its influence, the weather is extremely cold."

"Between the latitudes of 38° and 40° , longitudes 56° and 64° , I have known cruisers thrown out of their reckoning nine degrees of longitude in ten or eleven days by this current."—*Major Rennell's Investigation*, p. 180, 181.

REMARKS ON THE STREAM, between the meridians of 61° and 66° , in the months of May and October, by Mr. *Edw. Sabben*, master of H.M.S. *Niemen*, 1823.

"1st May, 1823; H.M.S. *Niemen*, Captain E. N. Sibly.—From 2 p. m. of April 30, being then in lat. $41^{\circ} 40'$ and long. $63^{\circ} 30'$, to 10 a. m. of May the 1st, when in lat. $40^{\circ} 30'$ and long. $63^{\circ} 10'$, felt the influence of a current, which, by repeated observations, appeared to set S. 72° E., or nearly E.S.E. $\frac{1}{2}$ E., one mile and nine-tenths an hour. On the 3rd, at 6 p. m., in latitude $39^{\circ} 10'$, and long. $65^{\circ} 55'$, the ship was in the middle of the Gulf Stream. At 6 p. m., on the next day, its southern edge was passed in latitude 38° and long. $64^{\circ} 30'$. The ship had now been set by the stream one degree and thirteen minutes due East, giving its velocity 2.3 miles per hour. The temperature of the water, at two p. m. was 77° ; at 3 h. 15 m. p. m. 76° ; at 5 h. 50 m. p. m. 72° ; and at 7 p. m. the same.

"Again, May 23rd, at 10 p. m. latitude, per account, 38° , and long. 65° , entered the Gulf Stream, having previously found an eddy setting westward, and extending about 15 miles south of the stream. May 24, at 9 h. 30 m. p. m. the ship was in lat. 40° and long. $61^{\circ} 50'$, and the current was then found to have set, during nine hours of the day, while accurate observations could be gotten, due East, more than 3 miles per hour.

"Crossing the Stream, in October, 1822, during favourable weather, between 38 and $39\frac{1}{2}^{\circ}$ N. and in longitude 63° , it was found setting S. 68° E. (nearly E.S.E.) 2.3 miles an hour, with an eddy on its southern edge, perhaps from 10 to 15 miles wide, running with about half that velocity."

With northerly winds, on the 11th of March, 1816, Captain Carlton, in the American ship *Grand Turk*, latitude $39^{\circ} 8'$, longitude $61^{\circ} 36'$, found the temperature of the air 44° , and of the water 68° . On the next day, in $39^{\circ} 36'$, and $59^{\circ} 3'$, the air was 46° , the water 66° , a difference of 20 degrees.

On the 15th of March the ship had advanced to the S.S.W. of the Newfoundland Bank, in latitude $40^{\circ} 42'$, long. $52^{\circ} 47'$; when it became remarkable that the temperature of the air was 64° , while that of the water had dropped to $59\frac{1}{2}^{\circ}$. On the next day, at half a degree from the southern edge of the Bank, in 42° N. and $49^{\circ} 51'$ W., the air was 56° , the water only 43° . Here the temperature was evidently lowered by an admixture of the Arctic waters from the North or N.N.E.*

It has been stated, generally, by writers of ability, from the information of American coasters, that the northern edge of the stream extends to the latitude of $41^{\circ} 20'$, or $41^{\circ} 30'$, on the meridian of the Isle of Sable (60° W.): but this assertion has been controverted by others, who have averred that its northern edge never ascends beyond the parallel of 40° . The latter is exceedingly erroneous; for many instances prove the contrary. Colonel Williams, in his 'Thermometrical Navigation,' (Philadelphia, 1799,) states, that, the whirlpools of the eddy, on the northern edge of the stream, have been seen in latitude $41^{\circ} 57'$, long. $65^{\circ} 1'$. He also observed great quantities of weed, supposed to be on the northern edge of the stream, in latitude $41^{\circ} 53'$, long. $65^{\circ} 33'$. It has subsequently been ascertained by Lieut. Chas. Hare, R.N., that, on the meridian of 57° W. in the summer season, (the rainy season of the West-Indies,) the northern edge of the stream ranges up to $42\frac{3}{4}^{\circ}$ N.: and, even in the winter months, to above 42° N. This has been confirmed by many voyages to North-America, assisted by chronometer, thermometer, &c., the last of which was made in the fall of the year 1839.

In the northern regions of the stream, when the cold upon land is in winter most intense, which is generally between December and March, heavy and continued gales very frequently prevail, which commonly proceed from between the North and West, across the course of the stream, from Cape Hatteras until past George's Bank, and bend its direction to the eastward; being aided, at the same time, by the discharge of the great bays and rivers, increased by the force of the wind blowing down them, and the constant supply of stream that passes along the coast of the Carolinas, the whole produces so strong a current to the

* In the month of June and beginning of July, and sometimes later, the ices from the Arctic Seas are frequently coming down from the northward in dangerous masses. In the same season the fishing vessels are very numerous upon the Bank, on and about the parallel of 45° N.; consequently, vessels bound to the eastward, from Nova-Scotia, &c. will avoid both, and most safely cross the Grand Bank, at this time of the year, by keeping in, or not proceeding to the northward of, latitude 44° .—(Captain Hare.)

eastward, as to render it impossible for a ship to approach the coast until a change of wind commences.

During the prevalence of a southerly or easterly wind, which is not so common here, it has been found that the current is forced close to, and in some parts upon, the edge of soundings; being thus pent in between the wind and the shoal grounds near the shore, the breadth is greatly diminished, and the velocity proportionably increased. This circumstance has been, in particular, observed from about the longitude of Block Island, along the edge of the Nantucket Bank, thence beyond George's Bank; and, also, along the coasts of Georgia and part of South Carolina. In the first instance, that the southerly winds forced the current to the edge of soundings, where it then ran from $1\frac{1}{2}$ to 2 knots: and, in the latter instance, that the easterly wind forced the current upon soundings. With West and N.W. winds, the stream would be removed some leagues farther off.

From what has been said, it is clear that, the eddies about the edges of the stream must vary according to the circumstances above explained. Along these edges, but more particularly along the outer edge, there is generally a current in a different direction, which is accelerated by the wind in proportion to its strength, blowing contrary to the stream, and retarded, or perhaps altogether obstructed, by the wind blowing in the direction of the stream. In the latter case, the limits of the stream will be extended.

The eddies on the inner edge are inconsiderable; but, on the outer one, in fine weather, they are strong, numerous, and of considerable extent.

EASTERN PORTION of the STREAM, between the meridians of 60° and 30° W. This portion of the stream is the most extensive, the most variable, and the most indefinable. On the meridian of 60° we find its northern boundary, in *summer*, as high as latitude $42\frac{1}{4}^{\circ}$. It then advances to the southern side of the Newfoundland Bank, and is found, even beyond this, to pursue an E. by N. course, until it reaches $44\frac{1}{2}^{\circ}$ North, on the meridian of 43° West, whence, generally, it inclines to the southward; and, finally losing its strength, it falls to the southward, westward of the Azores, between the meridian of 40° and 30° West. In the winter, the northern edge is from one-half to a whole degree lower in latitude than in summer, and does not, perhaps, exceed, on the meridian of 60° , $41\frac{1}{2}^{\circ}$ North.

The southern border of this portion of the stream seems to have no definable limit; it having, as already noticed, an invariable tendency to incline southward, while the great volume to the northward sets to the east. The velocities in the latter vary from more than 50 to 20 miles per day in August, decreasing eastward; and as August, with the early part of September, is the season of its greatest strength, allowance for its diminution is to be made between this period and February, when the stream is weakest.

It is almost superfluous to state that the stream may generally be traced by its *heat* or *temperature*, and comparing this temperature with that of the ocean beyond its limits. In the northern parallels this is more remarkable than in the southern; for we find that near the parallel of 40° , between the meridians of 60° and 50° , a temperature of 79° , 78° , and 77° , is common in the month of September, and between the meridians of 50° and 40° the temperatures of 76° to 74° are found. Near the same parallel (40°) in the month of March, we find between longitudes 60° and 50° , temperatures of only 65° to 60° ; and, between longitudes 50° and 40° , 59 degrees downward, and varying materially according to the approach of ices and currents from the northward.

On the meridian of 60° , the breadth of the stream, with its overflowing southerly waters, late in the summer, is about 350 miles. The *Drift Current* of the ocean, in more southerly parallels, and toward the Bermudas, runs counter to the Gulf-Stream, and though variable, more generally to the W.S.W. than to any other quarter. On the north of the stream there are various currents and rippings, according to the winds.

The GULF-STREAM is, in general, finally lost in the Sargasso or Weedy Sea, to the West and S.W. of the Azores, as we have shown in page 181, and which is more particularly described in Section III. hereafter. Southerly and S.W. winds, however, spread the surface water at times, much farther to the E.N.E. and East, as shown by temperature; but its general limits are as described.

REMARKS ON THE STREAM, by Capt. W. J. Monteath.—Between latitude $25^{\circ} 40'$ and $28^{\circ} 20'$, Captain Monteath found the current in the Strait had set 80 miles in the 24 hours, of June 27, 1820. On the southern border of the stream (northward of the parallel of Cape Hatteras) 6th July, 1820, lat. $35^{\circ} 20'$ to $36^{\circ} 30'$, long. $72^{\circ} 30'$ to $71^{\circ} 3'$, Captain M. found

found the current setting N. 45° E. 75 miles in the 24 hours. Next day, July 7, to lat. $37^{\circ} 40'$, long. 69° , he found it N. 53° E. 86 miles in 24 hours. On the following day, July 8, to lat. $38^{\circ} 38'$, long. 67° , it ran N. 58° E. 30 miles. July 9, to lat. $39^{\circ} 10'$, long. $66^{\circ} 10'$, westward only 10 miles. The observations were continued each day by chronometer, which agreed within a few miles.

In the Stream, on the 21st of March, 1824, lat. at noon $29^{\circ} 4'$, long. $79^{\circ} 22'$, *Captain Hamlin* found the stream had set North 83 miles: on the next day, lat. at noon, $31^{\circ} 8'$, long. $79^{\circ} 0'$, N.N.W. 63 miles.

Here we may remark, both from the observations of Capt. Jn. Wilson and Lieut. Hare, confirmed by recent surveys, that the southern edge of the Grand Bank of Newfoundland does not extend, by more than a degree, so far to the southward as represented in former charts. In lat. $42^{\circ} 50'$, long. $50^{\circ} 20'$, no bottom can be found with 150 fathoms of line; and it does not appear that any soundings can now be found to the southward of that parallel.

REMARKS ON THE STREAM, &c. by Captain J. Steele Park.—We have given on a preceding page (199), Captain Park's description of the north-westerly inset into the Mexican Sea, and his notice of the outset from the same. After rounding Cape Antonio, the land of Cuba was not seen. At this time, (the latter days of May, 1824,) the stream along the Florida side, and even in the Strait, was by no means so strong as it is generally found. In the narrowest part, where, of course, we have a right to expect the greatest velocity, it was running at the rate of only $2\frac{1}{2}$ miles in the hour. This was correctly ascertained by meridian altitudes of sun and moon, and an excellent chronometer.

"When we cleared the Gulf," Captain Park adds, "I was anxious to keep in the influence of the stream, and pass near the Tail of the Bank of Newfoundland, but it came on to blow hard from the northward, in latitude $34^{\circ} 35'$, and long. $72^{\circ} 20'$ (E. by S. from Cape Hatteras). This, of course, drove us away to the eastward, out of the favourite track, and we passed about 300 miles to the northward of the Bermudas. During this gale, for several days, a current was found to proceed from the eastward, to the W.S.W.,* but, in latitude 38° , and long. about 59° , the ship was in the Gulf-Stream, setting finely to the N.E.

"On June 23d, at noon, lat. $37^{\circ} 51'$, long. $61^{\circ} 54'$; June 24, lat. $39^{\circ} 56'$, long. $57^{\circ} 26'$, (by altitudes and chronometer.) Here the ship really made $4^{\circ} 28'$ of easting in the 24 hours' run, and the log gave only $3^{\circ} 16'$. In the same time much northing was made. The true difference of latitude was 125 minutes, but the log gave about 80 only. The vessel had been running all the time E. by N. by compass, and went through the water 173 miles. Allowing half a point of variation, gives the true course N.E. by E. $\frac{1}{2}$ E. Subsequently, on making Scilly, there was not an error in the watch of a single mile.

"After the gale from the northward subsided, the winds became variable between N.W. and S.W. The ship passed near the south side of the Great Bank, and continued to carry a fine north-easterly current, at the rate of thirty, twenty-five, and twenty, miles a day, until she reached lat. $43^{\circ} 35'$, and long. $36^{\circ} 50'$, where it ceased."

REMARKS BY CAPTAIN EDW. SABINE, made in *H.M. Ship PHEASANT*, 1822.

"There can be little hesitation in attributing the unusual extension of the stream in particular years to its greater initial velocity, occasioned by a more than ordinary difference in the levels of the Mexican Sea and of the Atlantic; it has been computed by Major Rennell, from the known velocity of the stream, at different points of its course, that, in the summer months, when its rapidity is greatest, the water requires about eleven weeks to run from the outlet of the Mexican Sea to the Azores, being about 3000 geographic miles."

July and August are generally the months of the greatest initial velocity of the stream, and the period when the levels of the Caribbean and Mexican Seas are most deranged.

The initial velocity in Nov. 1822, was 70 miles in the 24 hours. The temperature $80^{\circ}.8$ to $80^{\circ}.5$. After passing Cape Hatteras, 77 miles.

In the summer months, the stream issues from the outlet with a velocity nearly one-third greater than at the period of the Pheasant's voyage; or the latter part of November, 1822.

On the 5th of December, 1822, the Pheasant, bound to New York, quitted the northern

* Already noticed in page 182.

boundary of the stream in lat. $36\frac{1}{2}^{\circ}$, and long. $72\frac{1}{2}^{\circ}$. In the stream, in lat. $36^{\circ} 14'$, long. $72^{\circ} 25'$, the temperature of the surface water was 74° , and of the air 65° . Between 10 a.m. and noon the temperature had fallen from 74° to $62^{\circ}.4$, being a difference of 11.6. The surface-water on which the ship entered was in motion to the westward, at the average rate of 16 miles in the following 24 hours, and generally to the West and S.W. between the northern side of stream and the Banks on the Coast of Maryland. This motion may be more properly characterised as a *drift* current, occasioned by the prevalence and strength of recent northerly gales, than as a *counter* current. In approaching the bank (or soundings), the surface-water at 8 a.m. and at noon, on the 7th of December, was $59^{\circ}.5'$; at 3 p.m. it had fallen to $54^{\circ}.2'$; on which, upon sounding, bottom was found in 33 fathoms: on the following morning, in 30 fathoms, the surface was $53^{\circ}.5'$, and at 8 a.m. on the 9th, in 12 fathoms, but still with no land in sight (being 20 miles off the coast), $49^{\circ}.5'$. In the afternoon of the same day, when about two miles distant from Sandy Hook, (New York Harbour,) the water had finally lowered to 45° . Thus, in a space of the Ocean scarcely exceeding 200 miles in direct distance, the heat of the surface progressively diminished from 74° to 45° .

BOTTLE EXPERIMENTS, &c.

THE STREAM.—A bottle from H.M.S. *Breton*, Hon. Captain Gordon, 2nd Feb. 1830, in the Mexican Sea, latitude $27^{\circ} 50'$, longitude $84^{\circ} 40'$, the Tortugas bearing nearly S.S.E. 215 miles; found 2nd of June, 1830, in latitude $25^{\circ} 52'$, longitude $80^{\circ} 9'$, on the south-eastern coast of Florida, near White Inlet; where there is now a settlement.

A bottle from the *Lark*, steamer, lat. $24^{\circ} 29'$, long. $83^{\circ} 10'$, on the 12th of July, 1838; found on the beach of Looe Key, Florida Reef, in lat. $24^{\circ} 31'$, long. $81^{\circ} 31'$, May 20, 1839.

BETWEEN THE STREAM AND BAY OF FUNDY.—To the northward of the Gulf-Stream, a bottle was cast from the *Romney*, a troop-ship, Chas. Brown, commander, on the 13th of May, 1833, in lat. $42^{\circ} 10'$, long. $66^{\circ} 25'$. Wind S.W. Temperature of the air 50° ; of the water 38° . Picked up, 13th June, 1833, in St. Mary's Bay, at the west end of Nova-Scotia, $6\frac{1}{2}$ miles below the chapel, and about ten miles N.E. from Cape St. Mary, 12th of June, 1833; and not, as formerly stated, in St. Mary's Bay, Newfoundland.

GULF-STREAM to the AZORES.—A bottle from H. M.S. *Newcastle*, 20th of June, 1819, in latitude $39^{\circ} 12'$, long. $63^{\circ} 52'$; found on the beach of St. George, one of the Azores, 20th May, 1820, in about $38^{\circ} 40'$ N. and 28° W.

GULF-STREAM to IRELAND.—Another bottle from the *Newcastle*, 20th of June, 1819, in latitude $38^{\circ} 52'$, longitude 64° ; found on shore on the Rosses, on the N.W. of Ireland, near the Isle of Arran, 2nd June, 1820, and to which it must have been conveyed by the great easterly and northerly currents, after leaving the Gulf-Stream.

A bottle from the *Dove*, Capt. Kehoe, (no date) lat. 16° N., longitude 78° W. Found on the Ballyteigue coast, Wexford, about 16 miles from the Hook Lighthouse, in August, 1837. (*Conjectured to have been impelled to the west end of Cuba, and thence through the Florida Stream, &c.*)

GULF-STREAM to ST. GEORGE'S CHANNEL.—A bottle from the packet ship *South America*, March, 1833, cast into the Gulf-Stream off Cape Cod, in latitude $40^{\circ} 30'$ and longitude 68° . Found, in the year 1834, at Southport, on the coast of Lancashire.

A bottle from the ship *John Esdaile*, H. King, commander, thrown into the sea 28th July, 1821, in lat. $36^{\circ} 55'$, long. $71^{\circ} 50'$, was picked up on the sand near the mouth of the Ribble, Lancashire, 5th Dec. 1822. It was, therefore, after leaving the stream, set to the north-eastward.

LONGITUDE 44° to the ENGLISH CHANNEL, &c.—A bottle from the steam-ship *British Queen*, Captain J. Hamilton, 10th of August, 1838, ten days from New York, in latitude $43^{\circ} 53'$, longitude $44^{\circ} 33'$; picked up at Nieuport, near Ostend, October 15th, 1838.

INDICATIONS OF THE GULF-STREAM.

The indications of the stream are the *appearance* and the *temperature of the water*.
1. The stream, in its lower latitudes and usual course, in fair water, where it flows uninterrupted, may be known by its smooth and clear blue surface; for, without the line formed by a ripple on its edge, the water, in some places, appears like boiling water of a blue colour; and, in other places, it foams like the waters of a cataract, even in dead calms, and in places which are fathomless.

On the outer edge of the stream, especially in fair weather, there are great rippings, which are very perceptible. The appearance of the sea-weed, by day, is an indication of this edge of the stream; this weed being, *commonly*, on the edge without the stream, in greater quantity and larger clusters than within it.

It has been said that, the water within the stream does not sparkle in the night. We are assured by Captain Livingston, that, though this is a common, it is a misconceived, idea. "I have frequently seen it sparkle much; even last night it sparkled considerably, when we were in about 25° N. and 80° or $79^{\circ} 40'$ W.; and off Cape Roman, Cape Fear, Cape Hatteras, and the entrance of the Delaware, I have seen the water sparkle pretty much, though I think not equal to what it does in many other parts of the ocean."—*In the Stream*, 10th Sept. 1818. A. L.

The error, as to its not sparkling, has been shown, also, by Commissioner Ellicot, whose remarks are given hereafter.

The second and best indication of the stream is, *the temperature of its water*, which is considerably warmer than the water on either side of it. By an ingenious work, entitled "THERMOMETRICAL NAVIGATION," written by Col. Jonathan Williams, and published at Philadelphia, 1799, we are informed that *Commodore Truxton*, of the American Marine, had often ascertained the velocity of the Gulf-stream, to the northward of Cape Hatteras, and found it to be seldom less than one knot, and never more than two knots an hour. The temperature of the air and water without the stream was generally about the same; that is, the difference seldom exceeded 2 or 3 degrees; the air being sometimes the warmest; at other times the water.*

This gentleman has observed, "In the stream the water is much warmer than the air; indeed, I have known it 10 degrees warmer; but, as soon as you get within the stream, (that is, between it and the coast,) the water becomes colder than the air; and the more as you get on soundings, and approach the shore.† If mariners, who have not the opportunity of determining their longitude by celestial observations, will only *carry with them a good thermometer*, and try the temperature of the water, and compare it with that of the air every two hours, they may always know when they come into, or go out of, the Gulf-Stream. Indeed, I have always made a practice, when at sea, of comparing the temperature of the air and water daily, and often very frequently, during the day, throughout my voyage: whereby I immediately discovered any thing of a current that way going, and afterward found its strength and directions by observations for the latitude and longitude. It is of the utmost consequence, in making a passage to and from Europe, to be acquainted with this Gulf-stream; as, by keeping in it, when bound eastward, you shorten your

* "Notwithstanding what Commodore Truxton says, of its velocity off Cape Hatteras, in August, 1817, it set me, in the Young Dasher, one degree eight minutes, by stellar and solar observation, to the northward of dead-reckoning, in sixteen hours; and Captain Israel Coltart, of Philadelphia, informed me, that it set, occasionally, with even greater rapidity."—A. Livingston.

† "By the Journals of Captain W. Billings, of Philadelphia, it appears that, in June, 1791, the water on the coast of America was at the temperature of 61° , and in the Gulf-stream at 77° . By those of Mr. Williams, it appears that, in November, 1789, the water on the coast was 47° , and in the Gulf-stream at 70° , viz. :—

1791, June, Coast	61°	1789, November, Coast	47°	Difference between	Coast	14°
	Stream 77		Stream 70	June and Nov.		Stream 7
Stream warmer	16		23			

The difference of heat is, therefore, greater in winter than in summer. See the concluding observations hereafter.

In the America, of 500 tons, Captain Heth, for Richmond, Virginia, 2d May, 1817. "After a series of baffling winds and boisterous weather, we find ourselves on the western, or in, side of the Gulf-stream, and, of course, not far from our destination. Yesterday the temperature of the air was 65° , and of the water, 71° . To-day, the air remains at 65° , but the water has fallen to 50° . We have, therefore, crossed this warm ocean river, which flows from the Gulf of Mexico."

'NOTES' of Maurice Birkbeck.

"On my voyage from Philadelphia to Kingston, Jamaica, on board the schooner, Young Dasher, October, 1817, I particularly attended to the thermometer. Close off the Mouth of the Delaware, in about 16 fathoms, it stood at 60° ; on the inner edge of the Gulf-stream, it rose pretty rapidly to 66° ; and, in the course of an hour, to 76° ; next morning, 78° , which heat continued till we were to the southward of Bermuda; whence it gradually increased, until between Cuba, Hayti, and Jamaica, it was 82° , which appears to me to be the mean temperature of the sea-water about Jamaica."

—From memory, 26th August, 1818.

Andrew Livingston.

voyage;

voyage; and, by avoiding it, when returning to the westward, you facilitate it inconceivably; so much so, that I have frequently, when bound from Europe to America, spoke European ships, unacquainted with the strength and extent of it, off the Banks of Newfoundland, and been in port a very considerable time before them, by keeping out of the stream; whereas they lengthened their passage, by keeping in it. The general course of the Gulf-stream being marked on the Chart, I would advise those who make the northern passage from Europe, never to come nearer the inner line of it, by choice, than 10 or 15 leagues; and then the probability will be, that their passage will be assisted by the help of a counter-current, which often runs within it. In coming off a voyage from the southward, be sure to steer N.W. when approaching the stream, if the wind will permit you; and continue that course until you are within it, which may be easily known by the temperature of the water, as before mentioned. I have always considered it of the utmost consequence, when bound in, to cross the stream as speedily as possible, lest I should be visited by calms or adverse winds, and by those means drove far out of my way, which would prolong the voyage considerably, especially in the winter season."

By the advantage of knowing how near to the coast a ship may venture, and how to distinguish the Gulf-Stream from the water between it and the coast, we can be sure of a favourable current either way, and a small vessel might make a short voyage from Halifax to Georgia, which is thought by some a longer one than to Europe.—Suppose you had the wind a-head all the way; take your departure, and stand for the stream; so soon as you find the water to increase in heat, about half as much as you know it would when in the stream, heave about, and stand for the coast; you will infallibly discover the edge of soundings by the cooling of the water; then stand off again, and so on to the end of the voyage; when it is almost certain that the distance would be run in a shorter time than if there were no stream; for you would have a favourable inside or eddy-current. On the return passage, take your departure, and run off till you get into the warmest water, which will be the middle of the stream, and take the advantage of its current.

The following fact may serve to illustrate the propriety of these directions. In June, 1798, the mail-packet, for Charlestown, had twenty-five days' passage in going, but returned in seven. The Captain accounted for this by having calms, or very light airs, and a northerly current. This was the true cause. He was in the middle of the stream, where there generally are calms or light winds; the edges, only, which came in contact with colder regions, being tempestuous. After being in the latitude of Cape Hatteras, he found himself in that of Cape Henry (37 leagues to the northward). The vessel, however, arrived at last; and, on the return voyage, the Captain steered the same course back again, and with the same light airs he performed the voyage in seven days. Had the Captain known the use of the thermometer, need he to have been much longer in going than in coming?

It appears, also, by the work above quoted, that the thermometer is not only useful for ascertaining the current of the Gulf-Stream, but that it is likewise advantageous in discovering the approach to soundings from deep water.

In June, 1791, Captain W. Billings, of Philadelphia, in latitude 39 deg., longitude 56 deg., abreast of the Banks of Newfoundland, found that the mercury in the thermometer fell 10 degrees. It was near the same place that a similar observation was made by Dr. Franklin, in November, 1776; and another by Mr. Williams, in November, 1789, who has observed that, "By the coincidence of these three journals, at so great a distance of time, and without any connexion with each other, this important fact seems to be established:—
A NAVIGATOR MAY DISCOVER HIS APPROACH TOWARD OBJECTS OF DANGER, WHEN HE IS AT SUCH A DISTANCE AS TO BE ABLE EASILY TO AVOID THEM, BY ATTENTIVELY EXAMINING THE TEMPERATURE OF THE SEA; the water over banks and shoals, in these regions, being colder, in general, than that of the deep ocean.

At the edge of the Grand Bank of Newfoundland, the water has been found 5 degrees colder than the deep ocean to the eastward. The highest part of the bank is 10 degrees colder still, or 15 degrees colder than the ocean eastward.

On the coast of New England, near Cape Cod,* the water, out of soundings, is 8 or 10 degrees

* The bank from Cape Cod extends almost as far as Cape Sable, where it joins the banks of Nova Scotia, deepening gradually from 20 to 50 or 55 fathoms, which depth there is in latitude 43°. In crossing

degrees warmer than in soundings; and, in the stream, it is about 8 degrees warmer still: so that, in coming from the eastward, a fall of 8 degrees will indicate your leaving the stream, and a farther fall of 8 degrees will indicate your being on soundings.

On the coast, from Cape Henlopen to Cape Henry, the water, out of sounding, is 5 degrees warmer than in soundings; and in the stream about 5 degrees warmer still; so that, in coming from the eastward, a fall of 5 degrees will indicate your leaving the stream, and a farther fall of 5 degrees will give notice of soundings.

Colonel Williams recommends to seamen to take three thermometers. "Let them," he says, "be kept in one place some days previous to your sailing, in order to try their uniformity. The plate should be of ivory or metal, for wood will swell at sea, and, as the glass-tube will not yield, it is for this reason very liable to break; bell-metal is the best. Let the instrument be fixed in a square metal box, the bottom of which, as high as the mark 30 deg., should be water-tight, so that, in examining the degree of heat, the ball may be kept in the water; the remainder of the length should be open in front, with only two or three cross-bars to ward off any accidental blow, like the thermometer used by brewers. Fix one instrument in some part of the ship, in the shade; on part of one of the after-stations, under the quarter-rail, may answer, if no better place can be found.

"Let the second instrument be neatly slung, with a sufficiency of line to allow it to tow in the dead water of the wake. Put the other away safely, to be ready to supply the place of either of the others, in case of accident." *

ADDITIONAL PARTICULARS, as given in a letter from Fras. D. Mason, Esq. to Colonel Williams, commandant of the corps of engineers, and author of "Thermometrical Navigation," at New York, dated

"Clifton, (Eng.) 20th June, 1810.

"My voyage from New York to Halifax, in the British packet *Eliza*, was so very tempestuous and unfortunate, (having carried away our foremast,) that I did not make any thermometrical observations; but, when we sailed from Halifax, on the 27th of April, I began them, and continued till I unfortunately broke both my thermometers. However short the time was, you will perceive that my observations have been very important, and I herewith send the result of them. You will perceive with what fidelity the thermometer indicated the banks and the approximation toward islands of ice. The Captain was so convinced of the usefulness of the thermometer, that he made regular remarks, and inserted them in his journal. I gave him one of your books, thinking it would be pleasing to you that I should extend the knowledge of a discovery so useful as yours, and I wish it were more generally known. After having miraculously escaped the islands of ice, and several severe gales, we arrived at Falmouth on the 22d of May, 1810.

EXTRACT FROM THE *ELIZA'S JOURNAL*. (28th of April to 4th of May, 1810.)

DATES.	Hours A.M.	Hours P.M.	Heat of Air. Water.		Latitude North.	Longitude West.	Remarks, on Sailing from Halifax to the S.E. and Eastward.
1810.							
April 28	10	..	44	40	° /	° /	
		1	47	41	43 30	62 52	
		4	43	42	....	....
		3	46	40			Sable Bank.
— 29	8	..	45	43			
	Noon.		49	48	42 27	60 54	
			50	62			
			48	64			

crossing the bank between lat. 41° 41' and lat. 43°, the bottom is very remarkable; on the outside it is fine sand, shoaling gradually for several leagues; on the middle of the bank it is coarse sand or shingle, with pebble stones; on the inside it is muddy, with pieces of shells, and deepens suddenly from 45 or 48 to 150 or 160 fathoms.

* A description of a newly-invented case for the thermometer, intended to ascertain the temperature of the sea, is given in the Appendix, hereafter.

EXTRACT

EXTRACT FROM THE ELIZA'S JOURNAL, *continued*.

DATES.	Hours	Hours	Heat of		Latitude	Longitude	Remarks, on Sailing from Halifax to the S.E. and Eastward.
	A.M.	P.M.	Air.	Water.			
1810.			o	o	o	o	
April 29		10	48	54	....	....	{ Tacking toward the edge of the stream.
— 30	9		58	62	....	....
	Noon.		60	61	42 1	59 21	Steering in the stream.
		5	58	61			
		9	60	60			
May 1	8	..	60	58			
	11	..	60	46			
		2	64	45	41 53	56 52	
		3	62	46	....	....	{ An island of ice, bearing S.S.E. 7 miles.
		4	58	47	....	....
		5	60	47	....	....	{ Abreast of ice one-quarter of a mile to leeward.
		6	57	45			
		8	56	48			Island of ice bears S.S.W. 7 miles.
— 2	1	..	58	50			
	3	..	60	60			
	8	..	60	62			
	10	..	63	63			
	Noon.		64	63	41 25	53 8	
		3	61	64			
		6	62	58			
		9	56	56			
— 3		12	50	56	....	....	{ Sound with 80 fathoms, no bottom.
	4	..	43	43	....	....
	6	..	40	39	....	....	{ An enormous island of ice abreast, about 100 yards distant.*
	8	..	41	44	....	....
	10	..	43	45			{ Passed several islands of ice, the largest bearing S.W. 7 miles.
	Noon.		44	43	42 1	50 4	
		4	44	50			No bottom by 80 fathoms.
		6	46	60			
— 4	Midn.	12	46	60			
	4	..	46	52			
	8	..	43	60			
	Noon.		54	59	42 54	46 2	
		8	49	60			
		12	48	60			
	6	..	47	59			
	Noon.		53	59	43 12	41 43	Broke the thermometers.

* This was about 150 high, and one mile in diameter. When first discovered, it was not 100 yards from the vessel, and we were sailing directly toward it. The obscurity was then so great, that, at that distance, it appeared only like a white cloud, extending from the sea over our masts.

REMARKS, CONNECTED WITH THE ELIZA'S JOURNAL, BY COLONEL WILLIAMS.

"The important point of comparison is the difference in *the heat of the water in different places*, in or near the stream, in the ocean, out of the stream, on the coast, and near islands of ice; not the difference between the heat of the water and the air, as some have imagined. This latter is merely a concurrent observation; as it serves to account for ordinary changes, and thereby to guide the judgment.

"From April 28, at 10 *a. m.* to April 29, at 8 *a. m.* we see the temperature of the sea on the shoals of Sable, from 40 to 43. At 5 *p. m.* we see the warm influence of the Gulf-Stream from 62 to 64. At 10 *p. m.* we see the temperature between the influence of the stream in deep water and the coast, at 54°, which is about a mean between the two; then standing off shore, at 9 the next morning, 30th, we see the warm influence of the stream again.

"If these stripes of water had been distinguished by the colours of white, red, and blue, could they be more distinctly discoverable than they are by the constant use of the thermometer?

"About 23 hours afterward, (May 1st, at 8 *a. m.*) we find the water cooling; and, in three hours more, the mercury falls 14 degrees (46°). Here no bottom could be found by the lead, and there was probably an island of ice obscured by the fog. (Let it be remembered that the coldness of ice condenses the atmosphere, and of course the consequence must be fog.) Passing this at two *p. m.* the thermometer rose to 54°, but in one hour more it fell to 46° again, and an island of ice appeared at the distance of *seven miles*. Let navigators reflect on this, and say that a sudden fall of six degrees, in this part of the ocean, ought to induce them to haul to the southward, and keep a good look-out. From May 1, at 11 *a. m.*, to the next morning at one *a. m.* we see the gradual changes as the ship passes the ice, and comes again into ocean water (50°); but, in two hours more, the ship is in the warm influence of the stream again, and the mercury rises 10 degrees (60°). She proceeds in a nearly regular degree of heat during 17 hours; till, at 6 *p. m.* the water begins again to cool, falling to 56° at midnight. Here was no bottom at 80 fathoms. May 3, at 4 *a. m.* the water was at 43°, still no bottom in 80 fathoms. Now, from past experience, we must say, here is an island of ice in a less distance than seven miles, because at that distance the water was 46°. When day appears, behold an enormous island of ice, 100 yards a-breast, and the heat of the water reduced to 39°! A question now occurs,—Had not the thermometer been thus used, had it not been continued during the night, what would have been the fate of this ship? Let the recollection of the miserable fate of the ship *Jupiter** be an impressive answer; and let it be laid down as a maritime axiom, that want of caution, or ignorance, alone, can cause such accidents in future.

(Signed)

"JONA. WILLIAMS."

To the foregoing observations the Editor has now the satisfaction of adding, from the information of Mr. Rowland Bourke, commander of the ship *Archibald*, from the Havanna to London, 1816, that he had made experiments on the temperature of the water, which verified the principle developed by Colonel Williams. These experiments were made on leaving the Gulf-Stream, and on approaching soundings upon the edge of the Newfoundland Bank. Captain Bourke had been perusing a former edition of the present work; and, having accidentally a thermometer on board, "he thought," to use his own words, "that

* The Captain's protest, containing the particulars of the distressing circumstance of the ship *Jupiter*, states,

"April 6, in latitude 44° 20', longitude 49°, at 8 *a. m.* several pieces of broken ice, from which, at 11 the same day, we supposed ourselves entirely clear, and steering W. by N., West, E.N.E. and foggy weather. At two *p. m.* began to discover islands of ice again, and, at 3 o'clock, saw a large field a-head, which appeared to have no opening. We then wore ship, and kept off to the southward and eastward; continually passing small islands of ice, until 5 *p. m.*, when we found the ice extending so far to north and south, that we could not clear it. We then hove about, and stretched to the northward, among the broken ice, till night came on, and no prospect of getting clear. We hove-to under the three topsails double-reefed, in hopes to have sufficient drift to keep clear of the fields of ice to leeward until day-light; but found, at about 11, we were drifting fast upon a large field, and were obliged to wear ship, and haul to the southward under easy sail, luffing and bearing away from the broken ice as occasion required, until half-past twelve, when we struck a small piece, which went through the starboard bow."

he might as well try, by the temperature of a few buckets of water, whether it answered or not." The particular results were not committed to paper; but, in one instance, the Captain recollects a difference of seven degrees in the temperature of the water, within the space of a short time, when leaving the stream: subsequently a fall of several degrees announced the ship's approach to the bank. In brief, the whole accorded with the preceding explanation, and proved the great utility of an instrument, with which, in these respects, many seamen are yet unacquainted.

RE-FLOWING CURRENTS, &c.—On each side of the Gulf-Stream, as before noticed, there is commonly a drift or counter current setting in a different or contrary direction. Thus, in the Strait of Florida, between the stream and the coast, a smooth eddy takes its current, south-westerly, in an opposite direction to that of the main stream; and there is, even in its higher latitudes, a re-flow on either side.

Again, to the northward of Cape Canaveral, along the southern coast of the United States, you will find no tide farther out from the shore than in 10 or 12 fathoms of water; from that depth to the edge of soundings you will have a current setting to the southward, at the rate of one mile per hour; when out of soundings, you will have the Gulf-Stream setting to the northward.

The currents on the coast of North Carolina are governed mostly by the wind. During the summer months the prevailing winds are south-westerly, and the currents then set in the direction of the coast to the eastward; and, when the southerly winds cease blowing, it changes suddenly to the contrary direction, which is a sure precursor of a N.E. wind.

It has been found that, when Cape Henry (the South point of the Chesapeake) bore N.W. 160 leagues distant, a current was setting to the southward at the rate of 10 or 12 miles per day, which so continued until Cape Henry bore W.N.W. 89 or 90 leagues; the current was then found setting to the N.E. at the rate of 33 or 34 miles per day, which continued until within 32 or 30 leagues of the land; then a current set to the southward and westward at the rate of 10 or 15 miles per day, to within 12 or 15 miles of the land. This current, which is considered as the eddy of the Gulf-Stream, sets more or less to the S.W. according to the figure of the coast.

It has also been observed, by others, that a southern and western current constantly sets in higher latitudes between the Gulf-Stream and coast; more particularly in soundings, at the rate of half a mile an hour, or more, according to the wind.

An experienced officer of the Royal Navy, before quoted, has said that, "In all the observations I made during the five years' cruising on the American coast, I never found the eastern or Gulf current to the southward of latitude 36° , and only once so far; and I have often, about the latitude of 36° or 37° , and between the longitudes of 60° and 69° , found a strong current to the South or S.W." Therefore, ships from Europe, bound to America, should endeavour to make their passage either to the southward of latitude 37° , or to the northward of the latitudes already given; that is to say, when as far to the westward as the Banks of Newfoundland, they should, as much as possible, avoid beating against the wind to the westward, between the latitudes of 37 and 42 degrees. (*See page 208.*)

Upon soundings, along the coasts of Georgia, Carolina, Virginia, New Jersey, and New York, the current runs in general parallel to the shore; and is commonly influenced by the wind, which mostly prevails from between the South and West, producing a slow current of about one or a half mile to the N.E.; but, when the North and East winds prevail, the current along shore to the S.W. will frequently run two miles; on which the pilots of this coast remark, that the South and S.W. currents, though they but seldom happen, yet they are always stronger than those to the northward, which are more frequent. It is probable the tides may have some influence on these currents, particularly near the entry of the great bays and inlets. The flood on this coast comes from the N.E. In the months of April and May, I have observed, on crossing the Gulf-Stream, in the latitude of Cape Henry, that, when near the inside of the stream, the water begins to colour of a deeper green: and thence to the edge of soundings there is a strong current to the eastward. The colour of the water, from green, turns to muddy, when on soundings, the current still continuing until within the influence of the tide: this eastern current is, no doubt, occasioned by the discharge of water out of the Chesapeake, by the floods, from the snow melting in the country; and it prevails, in some degree, throughout the year, but its effect is greatest at this time. It is probable that a similar current prevails off the mouth of the Delaware.

Round the East end of Long Island, and thence, to the eastward, round Nantucket Shoals,

Shoals, across George's Bank, to Cape Sable, a strong tide runs; the flood setting to the North and West, in order to fill up the bays, rivers, and inlets, and the ebb the contrary. The tides that set across George's Bank into the Bay of Fundy are very much influenced by the winds, particularly if, after a strong South or S.E. wind, it should suddenly change to West or N.W. (circumstances that often happen); ships will then find themselves drifted by the outset 50 or 60 miles in the 24 hours, or more to the S.E. The indraught is also great with South or S.E. winds, which ought to be paid particular attention to.

Upon the Nova-Scotia coasts the currents run parallel to the shore, but are more frequent from the eastward than from the westward, particularly in the spring; the southerly winds force them upon shore by the water running in to fill up the bays and inlets; and the North and N.W. winds have the same effect in forcing them off the shore. A regular tide here runs along shore; the flood from E.N.E.

OFF-SET OR EASTERLY DRIFT FROM THE GULF-STREAM, ON THE NORTH AND N.E. OF THE BAHAMAS, &c.

From the superior elevation of the Gulf-Stream, its water, about the Bahamas, appears to have a drift or tendency to the eastward; and there is reason to believe that an off-set of the stream, from without the Maternillo Bank, sets, if not generally, very frequently, to the eastward and S.E. With the usual set of the currents, along the eastern range of the Bahama Islands, we are not accurately acquainted; but, with a N.W. wind, we have no doubt that it is in a S.E. direction. The Europa, a ship of war, returning to Jamaica, by this passage, from a cruise off Havanna, in 1787, steered East on the parallel of 30° N. with a westerly wind, until the run was supposed to have brought her on the meridian of Turk's Islands, by which it was intended to pass southward; but an *easterly* current had swept her along as high as that of the Mona Passage. Captain Manderson, of the Royal Navy, who first noticed this event, observes, "If it were once ascertained that a current was common in that part of the ocean, might it not be favourable for vessels bound from Jamaica to the Caribbee Islands, especially in the summer months, during the prevalence of the sea-breezes?"

Our respected friend, Captain Livingston says, "I have no doubt that there is a current, or rather off-set, from the Gulf-Stream to windward, between Bermuda and the Bahamas. In the Brilliant, we found ourselves retarded very much in making westing when running for the Hole in the Wall, one day about 30 miles of longitude, by excellent observations, the truth of which was confirmed by our land-fall. In the Dispatch, we got out of the Gulf on the 13th of March, 1819, when we were at noon, by observation, in latitude $28^{\circ} 0'$, longitude, by account, $79^{\circ} 12'$: on the 20th of March, at noon, we were, by meridian altitude, in lat. $29^{\circ} 48'$, and long. by acc. $72^{\circ} 32'$. Observations by sun and moon, a good lunar of three sights, altitudes and distances, and worked three times, gave $71^{\circ} 18' 30''$."

"In the schooner *Young Dasher*, January, 1818, I spoke an American vessel, out five days from the Chesapeake, in latitude $24^{\circ} 40'$, or thereabout; my longitude by lunars was then about $69^{\circ} 50'$; his, by dead-reckoning, was $72^{\circ} 20'$. On the 11th of February, 1819, in latitude about $25^{\circ} 10'$ N., we spoke the schooner Hester, Captain Lawrence, out five days from Bermuda, bound to Jamaica; his longitude was $69^{\circ} 15'$, ours, by observation, $68^{\circ} 39'$."

"In the ship *Fame*, Capt. J. W. Monteath, a good lunarian, assured me that he had been carried three degrees and upward to the eastward, between the time of his departure from the American coast and making the Windward Passages: but this may have been partly occasioned by the Gulf-Stream, which he may have crossed too obliquely in proceeding from Norfolk." The *Fame*, above-mentioned, was bound from Norfolk, in Virginia, to Kingston, Jamaica, in May, 1816; and, in a run of thirteen days, until in the latitude of 29° , and long. 61° , it was found that the current had set the vessel $3^{\circ} 10'$ E.

Captain Livingston adds, that "Captain Hall, in the brig *Lowland Lass*, passed to windward of Porto-Rico, when he thought that he had run through the Mona Passage. Captain Patterson, of the brig *Clyde*, as I am informed, passed down the Anegada Passage, when he intended to have made the Mona. I have heard of two vessels falling to leeward, but both were commanded by men whose names, as *seamen*, are not entitled to notice.

"In addition to the above notices, I have been assured, by an intelligent Spanish navigator, that, about thirty years since, vessels bound from Havana to Europe used generally to cut off three degrees of longitude from their reckoning, on account of this set, which he said was considered then as certainly existing. At that time the Charts were about a degree wrong, which would reduce the Spaniard's allowance to two degrees, or thereby.

"These notices tend to prove that an easterly off-set from the Gulf-Stream sets to the northward of the Bahamas: of this I am so firmly convinced, that if in charge of a ship from the Havana, or even New Orleans, bound to Jamaica, I should, if allowed to follow my own plan, run out the Strait of Florida, and attempt making my passage with the aid of this off-set. This is to be understood, in case I should not have westerly winds in the southern parallels; for such winds are, I am told, more frequent than formerly; and I know that they are by no means of rare occurrence on the S.W. of Cuba."*

OBSERVATIONS on the GULF-STREAM, &c. by SIR CHARLES BLAGDEN, M.D. and F.R.S., extracted from the PHILOSOPHICAL TRANSACTIONS.

"During a voyage to America, in the spring of the year 1776, I used frequently to examine the heat of sea-water, newly drawn, in order to compare it with that of the air. We made our passage far to the southward. In this situation, the greatest heat of the water, which I observed, was such as raised the quicksilver, in Fahrenheit's thermometer, to $77\frac{1}{2}^{\circ}$. This happened twice; the first time on the 10th of April, in latitude $21^{\circ} 10' N.$, and longitude, by our reckoning, $52^{\circ} W.$: and the second time, three days afterward, in latitude $22^{\circ} 7'$, and longitude 55° ; but, in general, the heat of the sea, near the tropic of Cancer, about the middle of April, was from 76 to 77 degrees.

"The rendezvous appointed for the Fleet being off Cape Fear, our course, on approaching the American coast, became north-westward. On the 23d† of April, the heat of the sun was 74° , our latitude, at noon, $28^{\circ} 7' N.$ Next day the heat was only 71° ; we were then in latitude $29^{\circ} 12'$; the heat of the water, therefore, was now lessening very fast, in proportion to the change of latitude. The 25th, our latitude was $31^{\circ} 3'$; but though we had thus gone almost 2 degrees farther to the northward, the heat of the sea was this day increased, it being 72° in the morning, and $72\frac{1}{2}^{\circ}$ in the evening. Next day, the 26th of April, at half-after eight in the morning, I again plunged the thermometer into sea-water, and was greatly surprised to see the quicksilver rise to 78° , and higher than I had ever observed it, even within the tropic. As the difference was too great to be imputed to any accidental variation, I immediately conceived that we must have come into the Gulf-Stream, the water of which still retained great part of the heat that it had acquired in the torrid zone. This idea was confirmed by the subsequent regular and quick diminution of the heat: the ship's run for a quarter of an hour had lessened it 2 degrees: the thermometer, at three-quarters after eight, being raised, by sea-water fresh drawn, only to 76° ; by nine the heat was reduced to 73° ; and, in a quarter of an hour more, to 71° nearly: all this time the wind blew fresh, and we were going seven knots an hour on a north-western course. The water now began to lose the fine transparent blue colour of the ocean, and to assume something of a greenish olive tinge, a well-known indication of soundings. Accordingly, between four and five in the afternoon, ground was struck with the lead, at the depth of eighty fathoms, the heat of the sea being then reduced to 69 degrees. In the course of the following night and next day, as we came into shallower water and nearer the land, the temperature of the sea gradually sank to 65° , which was nearly that of the air at the time.

* Captain Thomas Hamlin, in the brig *Recovery*, then in the Gulf-Stream, was set to the northward 104 miles, in the 24 hours of the 20th March, 1820. The ship's place, at noon, $28^{\circ} 4' N.$ $79^{\circ} 50' W.$ To the north-eastward, on the next day, without the stream, in lat. $29^{\circ} 35'$, long. $77^{\circ} 25'$, the current was found to have set only 11 miles north, but considerably more to the eastward.

On the 16th February, 1818, the ship *Mars*, under the same commander, was at the back of the Maternillo Bank, and no northerly current was found: and nearly two degrees farther eastward, in $28^{\circ} 7' N.$ and $76^{\circ} 58' W.$ the current, in 24 hours, had set $3' S.$ and $14' E.$ The ship was, therefore, evidently in the off-set from the Gulf-Stream.

† From the difference between civil and astronomical time, it becomes necessary to observe, that the former is always meant in this paper.

"Un-

" Unfortunately, bad weather, on the 26th, prevented us from taking an observation of the sun; but, on the 27th, though it was then cloudy, at noon, we calculated the latitude from two altitudes, and found it to be $33^{\circ} 26'$ N. The difference of this latitude from that which we had observed on the 25th, being $2^{\circ} 23'$, was so much greater than could be deduced from the ship's run, marked in the log-book, as to convince the seamen that we had been set many miles to the northward by the current.

" On the 25th, at noon, the longitude, by our reckoning, was 74 degrees W.; and I believe the computation to have been pretty just; but the soundings, together with the latitude, will determine the spot where these observations were made, better than any reckoning from the eastward. The ship's run, on the 26th, from nine in the forenoon to four in the afternoon, was about 10 leagues on a N.W. by N. course: soon afterwards we hove-to in order to sound; and, finding bottom, we went very slowly all night, and till noon the next day.

" From these observations, I think it may be concluded, that the Gulf-Stream, about the 33d degree of north latitude, and the 76th degree of longitude west of Greenwich, is, in the month of April, at least six degrees hotter than the water of the sea through which it runs. As the heat of the sea-water evidently began to increase in the evening of the 25th; and, as the observations show that we were getting out of the current when I first tried the heat in the morning of the 26th, it is most probable that the ship's run, during the night, is nearly the breadth of the stream, measured obliquely across; that, as it blew a fresh breeze, could not be less than 25 leagues in 15 hours, the distance of time between the two observations of the heat; and hence, the breadth of the stream may be estimated at 20 leagues. The breadth of the Gulf of Florida, which evidently bounds the stream at its origin, appears to be two or three miles less than this, excluding the rocks and sand-banks which surround the Bahama Islands, and the shallow water that extends to a considerable distance from the coast of Florida; and the correspondence of these measures is very remarkable, since the stream, from well-known principles of hydraulics, must gradually become wider as it gets to a greater distance from the channel from whence it issues.*

" If the heat of the Gulf of Mexico were known, many curious calculations might be formed, by comparing it with that of the current. The mean heat of Spanish Town, and Kingston, in Jamaica, seems not to exceed 81 degrees;† that of St. Domingo, on the sea-coast, may be estimated at the same, from Mons. Godin's observations;‡ but, as the coast of the continent, which bounds the Gulf to the westward and southward, is probably warmer, perhaps a degree or two may be allowed for the mean temperature of the climate over the whole bay: let it be stated at 82 or 83 degrees. Now there seems to be a great probability in the supposition, that the sea, at a certain comparatively small distance below its surface, agrees in heat pretty nearly with the average temperature of the air during the whole year in that part; and hence it may be conjectured, that, the greatest heat of the water, as it issues out of the bay to form the stream, is about 82° ,§ the small variations of temperature on the surface not being sufficient to affect materially that of the general mass. At the tropic of Cancer, I found the heat to be 77° ; the stream, therefore, in its

* Since Sir Charles Blagden wrote on the subject, the narrowest part of the Strait of Florida has been found to be only 12 leagues in breadth.—Ed.

† History of Jamaica, London, 1774, vol. iii. p. 652, 653. The different observations of the heat recorded in that work do not agree together; but those adopted here are taken from that series which appear to me the most correct.

‡ Monsieur Godin's experiments upon the pendulum were made at the Petit-Goave. They continued from the 24th of August to the 4th of September, and the average heat during that time was such as is indicated by 25 deg. of M. de Reaumur's thermometer, (see Mem. Acad. Science, 1735, p. 517.) according to M. de Luc's calculation, (see Modifications de l'Atmosphere, vol. i. p. 378,) the 25th degree of Reaumur's true thermometer answers to about the 85th of Fahrenheit's; but the average heat in Jamaica, during the months of August and September, is also 85 deg.; hence we may conclude, that, the mean heat for the whole year is nearly the same on the sea-coasts of both islands.

§ The lowest calculation of the mean temperature of the Gulf is preferred on this occasion, because of the constant influx of new water from the Atlantic Ocean, produced by the trade winds; which water, not having been near any land, must, I think, be sensibly colder than that which has remained some time enclosed in the bay. On this subject, the observations made by Alexander Dalrymple, Esq., relative to the heat of the sea near the coast of Guinea, ought to be consulted. (See Phil. Trans. vol. 68, p. 394, &c.)

whole course from the Gulf of Florida, may be supposed to have been constantly running through water from 4 to 6 degrees colder than itself, and yet it had lost only 4 degrees of heat, though the surrounding water, where I observed it, was 10° below the supposed original temperature of the water which forms the current. From this small diminution of the heat, in a distance, probably, of 300 miles, some idea may be acquired of the vast body of fluid, which sets out from the Gulf of Mexico, and of the great velocity of its motion. Numerous observations on the temperature of this stream, in every part of it, and at different seasons of the year, compared with the heat of the water in the surrounding seas, both within and without the tropic, would, I apprehend, be the best means of ascertaining its nature, and determining every material circumstance of its movement, especially if the effect of the current, in pushing ships to the northward, is carefully attended to, at the same time with the observations upon its heat."

On the 25th of September, 1777, as the ships which had transported Sir William Howe's army up Chesapeake Bay were returning toward the Delaware, with the sick and stores, they were overtaken, between Cape Charles and Cape Henlopen, by a violent gale of wind, which, after some variation, fixed ultimately at N.N.E., and continued five days without intermission. It blew so hard that we were constantly losing ground, and driving to the southward: we also, purposely, made some *easting*, to keep clear of the dangerous shoals which lie off Cape Hatteras.

On the 28th, at noon, our latitude was $36^{\circ} 40' N.$, and the heat of the sea, all day, about 65 degrees. On the 29th, our latitude was $36^{\circ} 2'$; we had, therefore, in the course of these 24 hours, been driven by the wind 38 nautical miles to the southward: the temperature of the sea continued nearly at 65° . Next day, the 30th, our latitude, at noon, was $35^{\circ} 44'$, only 18 miles farther to the southward, though, in the opinion of the seamen aboard, as well as my own, it had blown at least as hard on this as on any of the preceding days, and we had not been able to carry more sail; consequently, it may be concluded that, some current had set the ship 20 miles to the northward. To know whether this was the Gulf-Stream, let us consult the thermometer. At half-after nine in the forenoon of this day, the heat of the water was 76° , no less than 11 degrees above the temperature of the sea before we came into the current!

Toward evening the wind fell, and we stood N.W. by N. close-hauled. As the sea still ran very high, and the ship scarcely went above two knots an hour, we did not make less than three points of leeway on this tack; the course we made good, therefore, was W.N.W., which, on the distance run by noon next day, gave us about 16 miles of *nothing*; but that day, the 1st of October, our latitude was $36^{\circ} 22'$, 38 miles farther to the north than we had been the day before; the difference, 22 miles, must be attributed to the Gulf-Stream. This, however, is only part of the effect which the current would have produced upon the ship, if we had continued in it the whole four-and-twenty hours; for, though we were still in the stream at five o'clock in the afternoon of the 30th, as appeared by the heat of the water, being then above 75° ; and, at eight in the evening, the heat being still 74° , yet, by seven the next morning, we had certainly got clear of it, the heat of the sea being then reduced to its former standard of 65° . On this occasion, therefore, we did not cross the stream; but, having fallen in with it obliquely on the western side, we pushed out again on the same side, as soon as the gale abated.

These observations having been made three degrees to the northward of my former ones, it is curious to observe, that the heat of the Gulf-Stream was 2 degrees less. The seasons of the year, indeed, were very different: but, perhaps, under such circumstances that their effects were nearly balanced. In the latter observations, the meridian altitude of the sun was less; but then a hot summer preceded them; whereas, in the former, though the sun's power was become very great, yet the winter had been past but a short time. Calculating upon this proportion, we may be led to suspect, that, about the 27th degree of latitude, which is as soon as the stream has got clear of the Gulf of Florida, it begins sensibly to lose its heat from 82° , the supposed temperature of the Gulf of Mexico, and continues to lose it at the rate of about 2 degrees of Fahrenheit's scale to every 3 degrees of latitude, with some variation, probably as the surrounding sea and the air are warmer and colder at different seasons of the year.

The preceding facts had made me very desirous of observing the heat of the Gulf-Stream on my passage homeward; but a violent gale of wind, which came on two days after we

had

had sailed from Sandy Hook, disabled every person on board, who knew how to handle a thermometer, from keeping the deck. The master of the ship, however, an intelligent man, to whom I had communicated my views, assured me, that, on the second day of the gale, the water felt to him remarkably warm; we were then near the 70th degree of west longitude. This agrees very well with the common remark of seamen, who allege, that they are frequently sensible of the Gulf-Stream off Nantucket Shoals, a distance of more than a thousand miles from the Gulf of Florida! According to the calculation I have before adopted, of a loss of two degrees of heat for every 3 degrees of latitude, the temperature of the Gulf-Stream here would be nearly 73°; the difference of which, from 59°, the heat that I observed in the sea-water, both before and after the gale, might easily be perceived by the master of the vessel. This was in the winter-season, at the end of December.

An opinion prevails among seamen, that there is something peculiar in the weather about the Gulf-Stream. So far as I could judge, the heat of the air was considerably increased by it, as might be expected; but whether to a degree or extent sufficient for producing any material changes in the atmosphere, must be determined by future observations.

Perhaps other currents may be found, which, issuing from places warmer or colder than the surrounding sea, differ from it in their temperature so much as to be discovered by the thermometer. Should there be many such, this instrument will come to be ranked among the most valuable at sea; as the difficulty of ascertaining currents is well known to be one of the greatest defects in the present art of navigation.

In the mean time, I hope the observations which have been here related are sufficient to prove, that, in crossing the Gulf-Stream, very essential advantages may be derived from the use of the thermometer; for, if the master of a ship, bound to any of the southern provinces of North-America, will be careful to try the heat of the sea frequently, he must discover very accurately his entrance into the Gulf-Stream, by the sudden increase of the heat; and a continuance of the same experiment will show him, with equal exactness, how long he remains in it. Hence he will always be able to make a proper allowance for the number of miles that the ship is set to the northward, by multiplying the time into the velocity of the current. Though this velocity is hitherto very imperfectly known, from want of some method of determining how long the current acted upon the ships, yet all uncertainty arising from thence must soon cease, as a few experiments upon the heat of the stream, compared with the ship's run, checked by observations of the latitude, will ascertain its motion with sufficient precision. From differences in the wind, and perhaps other circumstances, it is probable, that, there may be some variations in the velocity of the current; and it will be curious to observe, whether these variations may not frequently be pointed out by a difference in its temperature; as the quicker the current moves, the less heat is likely to be lost, and, consequently, the hotter will the water be. In this observation, however, the season of the year must always be considered; partly, because it may, perhaps, in some degree, affect the original temperature of the water in the Gulf of Mexico: but, principally, because the actual heat of the stream must be greater or less in proportion as the tract of the sea, through which it has flown, was warmer or colder. In winter, I should suppose, that the heat of the stream itself would be rather less than in summer; but that the difference between it and the surrounding sea would be much greater; and, I conceive that, in the middle of summer, though the stream had lost very little of its original heat, yet the sea might, in some parts, acquire so nearly the same temperature, as to render it scarcely possible to distinguish, by the thermometer, when a ship entered into the current.

Besides the convenience of correcting a ship's course, by knowing how to make a proper allowance for the distance she is set to the northward by the current, a method of determining with certainty when she enters into the Gulf-Stream is attended with the farther inestimable advantages of showing her place upon the ocean in the most critical situation: for, as the current sets along the Coast of America, at no great distance from soundings, the mariner, when he finds this sudden increase of heat in the sea, will be warned of his approach to the coast, and will thus have timely notice to take the necessary precautions for the safety of his vessel. As the course of the Gulf-Stream comes to be more accurately known, from repeated observations of the heat and latitudes, this method of determining the ship's place will be proportionably more applicable to use. And it derives additional importance from the peculiar circumstances of the American coast, which, from the mouth of the Delaware to the southernmost point of Florida, is every where low, and beset with frequent

frequent shoals, running out so far into the sea, that a vessel may be aground in many places where the shore is not to be distinguished even from the mast-head. The Gulf-Stream, therefore, which has hitherto served only to increase the perplexities of seamen, will now, if these observations are found to be just in practice, become one of the chief means of their preservation upon that dangerous coast.

REMARKS ON THE GULF-STREAM BY COMMISSIONER ELLICOTT.

We shall conclude this division with some corroborative and additional remarks, from the pen of an eminent and scientific citizen of the United States, Commissioner Andrew Ellicott. This gentleman, in allusion to the difference of temperature in the water, says, "This difference of temperature arises from the water in the Stream's remaining a considerable time nearer the equator, and then flowing with rapidity into a colder climate; and though, as it proceeds northward, it continues to lose its heat, it is, nevertheless, passing through water which still becomes colder as it advances north, so that the relative difference continues nearly the same for a great distance. The difference which I generally found between the water in the stream, and the eddy water on the coast, was about 7 degrees.

"It has been supposed, by some ingenious writers, that, because after leaving the stream, and having soundings on our coast, and a diminution in the heat of the water, about the same time, it followed, of course, that the water on soundings and banks is always colder than the water adjoining. Though this may constantly be the case on our coast, it is probable the conclusion ought to be considered as a *particular, and not a general, one*. On our coast the stream passes nearly along the great bank of soundings; it is, therefore, very natural to suppose that, soon after leaving the Stream, you will have soundings, and be in one of the large eddies on the coast, whose waters, being nearly stationary, are therefore colder than that moving with rapidity from the southward. Again, it may be observed that, the adjoining water in the Atlantic, without the Stream, is also colder, as well as that on soundings; but, on the contrary, fathomless. Hence the difference in this case does not appear to depend upon the depth of the water, but upon a current setting rapidly from a warmer into a colder climate. From this a conclusion may very fairly be drawn, that *the sudden changes found in the temperature of the water in the Ocean are more immediately the effect of CURRENTS than of BANKS and SOUNDINGS*; but, as these currents are generally near coasts, and frequently occasioned by them, the thermometer may be considered a good monitor.

"It has been mentioned by Dr. Franklin, that the water of the Gulf-Stream *does not sparkle in the night*. This, so far as my observations go, is incorrect: I saw little or no difference between that and the other water on the coast; but, if there was any, that of the Gulf-Stream was the most sparkling and luminous. It may, however, be observed that, the same water is very different, at different times, in this respect.

"The same ingenious writer and philosopher likewise observes, that the Gulf-weed is a sign of being in the Stream. This is, in part true, but by no means to be considered as a general rule, because *the water on the borders of the Stream is constantly mixing with the adjoining water, and leaving some of the weed behind*, which consequently falls into the eddy currents, and is carried off many leagues. We meet with it on soundings, in the eddy current, setting southerly. These remarks cannot affect the character of Dr. Franklin, either as a writer or philosopher; his character is formed of materials which will elude the destroying hand of time itself, and will be revered so long as liberty and science command the affections and esteem of mankind. I merely think the Doctor was mistaken, and conceive it to be my duty to state facts."*

The Description of, and Directions for Sailing through, the Gulf-Stream, from the Spanish Directory, entitled, '*Derotero de las Antillas*,' &c. will be found hereafter, in the Directions for ships bound to and from the West-Indies.

8. THE NEWFOUNDLAND CURRENTS.

We have shown, in a former division on the existing Currents, (page 166,) how they set from Hudson's Strait to the Eastern Coast of Newfoundland, and through the Strait of

* "Journal of Andrew Ellicott, late Commissioner on behalf of the United States, for determining the Boundary between the United States and the Spanish Possessions."—Quarto, Philadelphia, 1803.

Belle-Isle into the Gulf of St. Lawrence. Thus it may be seen that they also affect the western navigation of the island. Added to this, is the water brought down by the vast ebb of the River of St. Lawrence, which constantly sets down, with great strength, into the Gulf, as shown in the remarks on tides, page 149. Thus is the Gulf supplied with water, which can escape by the southward only. In the early part of the year, when the snows and ices are in a melting state, the outset must be considerably increased; it may, therefore, be presumed, that there is, in this season, a considerable efflux or stream of water from the Gulf, setting to the South, S.W., and South-eastward.

It appears that we have now to consider and combine, 1st, the operation of the Davis' Strait Current, setting S.E., S.S.E., and E.S.E.; and which winds about Newfoundland in a W.S.W. direction; 2dly, the current which sets down the Strait of Belle-Isle, from the same stream; 3dly, the copious ebb from the River of St. Lawrence; 4thly, a counter-current along Breton Island and Nova-Scotia; and, 5thly, the whirls or eddy and counter-currents which are found between the Gulf-Stream and Nova-Scotia.

Captain Pornton, a commander, who has long sailed in the Newfoundland trade, states that the branch of current, which appears to come from Hudson's Bay, always sets to the south-westward, off the eastern coast of Newfoundland: sometimes with a velocity of two miles an hour. Its strength, however, varies, with the direction and force of the wind. Passing down the eastern coast of Newfoundland, it turns round Cape Race, and sets thence, along the south side of the island, until it meets with the current from the St. Lawrence, a little to the westward of St. Peter's and Miquelon Islands. The combined action of these two currents, with that of the Stream to the southward, may, perhaps, produce that *counter current* which has been found along the inner edge of the Gulf-Stream: But, be this as it may, it is very probable that it is owing to the influence of the Hudson's Bay current that so many shipwrecks happen on the south coast of Newfoundland, about Cape Pine, &c. For ships coming from the St. Lawrence and thence along the coast of Newfoundland, meet this current; and, if it happen that they have calms, or light or head winds, it sets them imperceptibly to the westward of their reckoning: and when, supposing that they are to the eastward of Cape Race, they alter their course more to the northward, should the weather, as it often is, be foggy, they get on shore at a time when they consider themselves clear of the land.*

At times, it seems, the westerly current may extend farther than the limit above described. In a letter from a captain of the Royal Navy, dated *Breton Island*, 13th May, 1822, we have the following expressions:—"It frequently happens that a ship bound from England to Quebec, strikes soundings on the Banks of Newfoundland, and shapes her course thence to pass between Cape North, on Breton Island, and Cape Ray on Newfoundland, into the Gulf of St. Lawrence, without seeing the land, which is hid in fog; and, unable to make a proper allowance for a current that sometimes runs at the rate of *four miles an hour*, is swept away to the westward, and runs, with a leading wind, on our iron-bound shores, when her commander fancies he is steering directly into the gulf; a misfortune that is too often announced by the bodies of the unhappy mariners, and the fragments of their vessels with which our shores are strewn.

"It should be made known that there is a settlement on Ashpé Bay, to the southward of Cape North; as from want of this information, many an unfortunate seaman has perished from cold and hunger, after escaping shipwreck; and that vessels of any draught of water may safely anchor all round the island, as wind and weather may require. The soundings, at half to three-quarters of a mile, are 7 and 8 fathoms."†

Upon a survey of the *Virgin Rocks*, in July, 1829, the current, at about 80 miles E. by S. from Cape Race, was found setting over them to the W.S.W. at the rate of one mile an hour.

It is probable that this westerly current impinges on the easterly one, and continues its course, with diminishing velocity, toward Breton Island, where it blends with that branch of the St. Lawrence Stream which sets to the S.W. between Sable Island and Nova-Scotia.

The British frigate, *Tweed*, on her passage to St. John's, Newfoundland, struck upon the coast, near Cape Spear, and was wrecked in the night of the 5th of November, 1813. This event, most probably, was the effect of an unknown south-westerly current.

* Substance of a communication to and from the late Mr. Wm. Heron, of Greenock.

† See the Note (2) on St. Paul's Island, page 48; and on Lighthouses, &c., page 53.

To different currents must be attributed the loss of the sloop *Comus*, the transport Harpooner, H.M. ship *Drake*, and the brig *Spence*, all of which were lost, at different times upon *one spot*; the little bay, called *St. Shot's Bay*, on the south coast of Newfoundland, and lying between Cape Freels and St. Mary's Bay. The particulars of all these melancholy events have been given in our Book of Directions for Newfoundland, 1824; and, therefore, need not be repeated. The *Comus* was from the west, and was lost in the night of the 24th of October, 1816, after having sounded, as supposed, on the inner edge of the Green Bank. The *Harpooner*, a transport, with troops, was from Quebec, and bound for London. She struck at 9 p.m. of November 10, 1816. The *Drake* sailed from Halifax for St. John's, 20th June, 1822, under very favourable circumstances, upon a direct course, for Cape Race; but on the 23rd the weather became thick, and at noon she was supposed to be 90 miles from Cape Race, but at 7½ p.m. breakers were reported a-head, and the ship was soon after a total wreck. The *Spence* was from Richibucto, in the Gulf of St. Lawrence, with lumber, bound to Liverpool, and was totally lost at St. Shots, at 4 p.m. 16th July, 1822. Another vessel, the *George Canning*, from Chaleur Bay to Aberdeen, was wrecked here, during a dense fog, on the 17th of June, 1829.

These events imperiously demand an inquiry into the causes. The five vessels, it may be seen, were all from the *westward*, and all, it may be presumed, were set to the *northward* as well as to the *westward*, of the situations which they were supposed to occupy, and the route which each intended to pursue. They can, at present, be accounted for only by the supposition of currents winding round the coast, opposing each other, and operating as above explained; for it seems clear that the westerly current from the Grand Bank so opposes the easterly one as to limit its operation *eastward*, and give it a northern inflection; thus producing the indraughts into the southern bays of the island.

It has been already shown that the waters of the St. Lawrence run off partly to the S.W. from Breton Island; so that here, likewise, allowance for a westerly set is to be made: for, as Mr. Darby has said, "On the south side of *SABLE ISLAND*, the *Current*, in shoal water, with prevailing South and S.W. winds, sets rapidly eastward until it reaches the end of the N.E. Bar. It then unites and blends with the *St. Lawrence Stream*, which passes the Bar in a S.S.W. direction, and runs strongest in April, May, and June. I have sufficient reason for believing that the Gulf-Stream, on the parallel of 42° 30', running E.N.E. occasions the St. Lawrence' Stream, then running S.S.W. to glide to westward. The strength of this stream has never been noticed, and three-fourths of the vessels lost on Sable Island have been supposed to have been to the *eastward* of the island, when, in fact, they were in the longitude of it.*

The winds hereabout have been noticed on page 109: and there can be little doubt that their irregularities produce as various changes in the Currents.

NEWFOUNDLAND BANK, &c.—The navigation about and to the southward of, the Newfoundland Bank, seems to require all the seaman's spirit, skill, and vigilance; for here, in particular, he may have to combat with the contending elements. This we shall show by several examples.

I.—It appears that the south-westerly current, over the Grand Bank, sets over the whole of the northern part of that bank; while the stream from the S.W. sets over the southern part, thus producing an admixture of waters from the N.E. and S.W. In a summer voyage, 1826, lat. 46° 24', Lieut. Hare (30th Sept.) sounded on the outer edge of the bank, with thick blowing weather from S.W., and, on the next day, in 45° 56' N. and 48° 6' W. had no bottom at 120 fathoms, with a very heavy swell from W.S.W. although he found that a current had carried him S. 67° W. 34 miles. Thus appeared, in close conjunction, a south-westerly current, with another from W.S.W. where the edges of the two entered into collision with each other.

LIEUT. EVANS, in describing his run across the Atlantic, from Newfoundland, in June, 1828, says, "We experienced a current setting to the northward, sometimes as much as twenty miles in the twenty-four hours; this circumstance, so contrary to the generally

* The current from the Gulf is commonly supposed to set south-eastward, if not checked during easterly winds and calm weather, when it runs in the contrary direction: but the winds both here and at a distance possess so powerful and irregular an action as to render the set very variable.—*Capt. Bayfield.*

received opinion of a *permanent* current from the north, may be accounted for satisfactorily, from the circumstance of the winds being principally from the South and S.W. A long continuance of southerly winds would have the effect of turning the fluent waters of the Florida Stream, east of the Banks, to the northward and eastward, sufficient to produce the superficial current we experienced, and to check the general flow of the waters from the northward. We met no ice of any description, nor any indication of its vicinity, unless when crossing the tail of the Bank; the constant southerly winds, of course, will easily account for our not seeing any of these formidable dangers; but it is remarkable, (and the instance is a proof of our imperfect knowledge of the theory of winds,) that an American brig, making a similar run at the same time, but being about a degree or two farther north than our parallel, had to contend with strong northerly gales, and to encounter numerous icebergs."

II. SOUTHWARD of the BANK.—The brig *RECOVERY*, Captain *T. Hamlin*, on her return from New Orleans toward Greenock, 21st April, 1822, was proceeding E.N.E. on the parallel of 40° toward the Grand Bank. In the first part of the twenty-four hours the weather was moderate, a breeze sprung up at West, and the vessel made all sail. In the middle part strong gales succeeded, still at West, and sail was reduced. At one *a.m.* black and gloomy, with rain. At 5, a strong gale from the *eastward* took the ship aback, and drove her astern against the old sea: it struck the boat, and broke the larboard davit, and a new sea rising with the shift of wind, the two seas met in dreadful confusion. With a scend forward the brig dipped the jib-boom under, and broke it off in the cap; and, with the scend aft again, stove in the cabin window. While all hands were employed, trying to secure the boat, repeated seas struck her, and at length raised her above the stern, and unshipt the other davit. They then held on the tackle-fall that was fast to her, and dropt her astern, with the hope that a favourable opportunity might occur for taking her in, but she filled and broke adrift. From 5 to 8 the wind continued to blow a gale; sometimes at East, then at West, and back again repeatedly; while the vessel was quite unmanageable, and lying exposed to the contending elements. At 8 *a.m.* the easterly wind prevailed, and the vessel was then laid-to under close reefed main topsail, &c. Lat. at noon, by acc. $40^{\circ} 25'$, long. $53^{\circ} 0'$. At one *p.m.* of the 22d, it became calm: the vessel then drifted with the sea, going round and round; but on the next day the wind was fair at S.W. and the brig proceeded eastward.

At one *a.m.* on the 23d, a sensible change in the atmosphere and sea was experienced; from which it was concluded that the *Recovery* had entered on the Grand Bank. At daylight the colour of the water was found to be altered, and a numerous quantity of ice-birds and murre were upon it.

On the 31st of October and 1st of November, 1822, the *Recovery*, on her return from New Orleans to London, at $3\frac{1}{2}$ degrees more to the southward, and nearly on the same meridians, met with heavy squalls, a strong gale from the N.W., and a high cross sea, which continued for nearly 24 hours, and to longitude 48° .

Between the meridians of 52° and 47° W. 28th to 31st July, 1823, Captain Hamlin, in the ship *George IV.*, from the S.W., crossed the parallel of 40° N., all moderate and pleasant weather, with N.W. and westerly winds.

Ship *George IV.*, 3d April, 1824, homeward. "Squally and unsettled with lightning: at noon, lat. $40^{\circ} 14'$, long. $50^{\circ} 33'$. Next day, variable, with heavy showers. On the 5th, heavy showers of hail, succeeded by a smart breeze from the North. Lat. at noon, $40^{\circ} 23'$, long. $46\frac{1}{2}^{\circ}$."

III. Remarks from the Journal of Lieutenant J. Steele Park:—On *Monday*, 9th July, 1827, our latitude at noon was $40^{\circ} 29'$ N. and the longitude $53^{\circ} 30'$ W. by lunars and chronometer. The temperature of the water 73 degrees, and the air 75 degrees; the wind S.E. by E., a light breeze: the ship close hauled on the starboard tack, lying N.E. by E. and going two knots. At 5 *p.m.* tried the water again, and found the temperature down to 67° ! I love the ship to immediately to sound, but got no bottom with 100 fathoms of line, right up and down. Nothing to be seen from the mast-head; no ice nor danger of any kind, and the temperature of the air not affected. Took altitudes for the chronometer at the same time, which made the longitude $53^{\circ} 18'$. We then filled and made sail again. At 5 *h. 30 m.* the water was one degree warmer, viz. 68° ; at 6 it was 69° ; at 7 69° ; at 8 70° ; at 10 70° ; and at midnight it was 71° . On Tuesday morning, at 4 o'clock, the water was 72° ; at 8 it stood at 74° ; and, at noon, 74° ; when the lat. and long. were $41^{\circ} 16'$ N., $52^{\circ} 24'$ W.

"Had the atmosphere not been perfectly clear when we hove the ship to, I should have suspected that we were in the vicinity of an iceberg, but it was serene and beautiful; therefore the sudden fall of 6 degrees of the thermometer, in this part of the ocean, must be attributed to some other cause. There is a danger of some kind laid down about this spot by Capt. Watson, of Liverpool (to say nothing of our old friend 'Daraith'). If it exists in the position assigned to it, I must have passed very close to it; indeed I have been keeping a strict look out for it all last night and this morning; and we have sailed over the very place where it appears in Purdy's Chart of the Atlantic. However, the water has been so remarkably smooth and unruffled, that we may have passed within a ship's length of a 'rock even with the water,' without perceiving it.

"I am inclined to believe that we should have found the temperature of the sea below 67 degrees if it had been tried an hour or two sooner. We have a right to presume that it was rising when I first discovered the change; for, half an hour afterward, it was 68°, and it went on progressively, getting warmer and warmer, until it mounted up to 74 degrees, and there it stopped: thus furnishing a beautiful illustration of the susceptibility, and therefore the usefulness, of this most simple of all instruments.

"The lat. of the ship (at 5 p. m. Monday) may be called 40° 36', the long. 53° 18'.

"Wednesday, July 11th.—The temperature of the water I try every four hours on ordinary occasions; and every hour, or every half-hour, in approaching soundings or 'Vigia.' Indeed, I make use of the thermometer as an amusement. I try it sometimes half a dozen times in a watch, and a most interesting amusement it is; more especially to sailors who navigate in the common loose random way, without a chronometer, and without any knowledge of lunars.

"Now, the temperature of the water was 74 degrees yesterday morning at 8 o'clock, and it continued nearly the same till midnight, when I found it cooling a little: it was then 71°. During the night it was neglected, and I can say nothing, with certainty, about the temperature; but I felt a very sensible change in the atmosphere this morning when I went on deck; and when I plunged the thermometer into the sea, I was surprised to see it down to 58 degrees. We hove the ship to again, and passed the lead forward, but there was no bottom with 100 fathoms of line. As I knew we were only about the parallel of 42°, I did not expect soundings, but I thought it right to try, and make quite sure of the thing. The weather very fine, and nothing in sight from the mast-head. Thermometer in the shade 63° with a southerly wind, and yesterday it was upward of 70°. Altitudes for the chronometer were taken, when we hove to, which made the longitude 50° 20'; and the observed lat. at noon was 42° 7'. The ship made 5' of nothing in the interval between noon and the time we tried the lead, so we must have been in 42° 2' N., and 50° 20' W. at 8 o'clock this morning, when the water was down to 58°. At 9 it was 57°; at 10, 56°; at 11, 56°; at noon, 56°; at 2 p. m. 57°; at 4, 58°; at 8, 59°; and at midnight 60°.

"Sunday, July 15th.—There was very little change in the temperature of the water, from midnight of the 11th till this day at noon, in lat. 44° 17', long. 45° 4'. The cold has been diminishing gradually and very slowly (the atmosphere as well as the sea), but the water is now up again to 70°, and the air to 74°.

"I presume the great difference in the temperature of the ocean-water, discovered on Wednesday morning, must be ascribed to the proximity of the Grand Bank of Newfoundland; but if the generally received opinion be correct, that 'the water is' only '5 degrees colder at the edge of the bank than the deep ocean,' how are we to account for a fall of 14 or 15 degrees when we were unquestionably in very deep water, and 30 or 40 miles, at least, from the nearest soundings on the very tail of the bank? This is a problem I do not pretend to know much about, but I cannot help thinking that the Bank of Newfoundland chills the adjacent water to a greater distance than is commonly imagined.

"By the bye, I may notice here again (*en passant*) what I have had occasion to remark more than once before; that is, the northerly set which I have uniformly encountered near the tail of the bank. Now, on the 11th, last Wednesday, the weather was beautiful; but the next day a fog, with all the density so peculiar to this part of the ocean, closed round us, and we were left to grope about in the dark, or by dead reckoning, which is the same thing. We never got a glimpse of the blue sky until this morning, when, by chronometer and excellent lunar distances, together with the sun's meridian altitude, we find out that a current has swept us N. 10° E. 54 miles in 3 days. I must confess my ignorance of the exact

exact magnetic variation, but I allowed two points; which, I believe, is considered ample allowance in this part of the Atlantic. The lat. to-day, at noon, is $44^{\circ} 17'$, long. by chronometer and lunars, which go hand-in-hand uncommonly well, $45^{\circ} 4'$.

“During the three days’ fog the wind was southerly; we, of course, were standing to the eastward, and I could not understand why the temperature of the sea continued so low and so nearly in the same state all the time; for, according to our calculation, we were making a great deal of easting, consequently increasing our distance from the Bank; but, when it brightened up, the mystery was explained; we then discovered that the northerly current had carried the ship round the tail, on a course almost parallel to the edge of soundings; therefore the change was slow and gradual until we got beyond its influence.”

IV. TEMPERATURES EASTWARD of the GRAND BANK.—On the 29th *September*, 1826, Lieut. Hare, in latitude $45^{\circ} 38'$ N. and $46^{\circ} 1'$ W. about 25 leagues eastward of the bank, found the temperature of the water only 59° . On the preceding day, in $44^{\circ} 46'$ N. and $44^{\circ} 3'$ W. it was 66° . On the 25th, in $45^{\circ} 43'$ N. and $38^{\circ} 13'$ W. it was 70° . On the 24th, in $46^{\circ} 50'$ N. and $36^{\circ} 18'$ W. it was 69° with much weed. These temperatures indicate that the surface-current was from the south-westward, almost up to 47° N. in $36\frac{1}{2}$ W. in the autumn of 1826; they corroborate the preceding remarks, and show that the eastern part of the stream, in this season, expands, or is impelled very much to the northward. (See farther on this subject the following remarks by Lieut. Park, on June 23, July 2nd, 4th, and 5th, 1826.)

9. GENERAL REMARKS on the CURRENTS between JAMAICA and EUROPE.

1.—REMARKS made on board the *CARSHALTON PARK*, on her passage to LONDON, from JAMAICA, in 1826, by JOHN STEELE PARK, Lieut. R.N.

[The given latitude is generally that by sun’s meridian altitude; and the longitude by chronometer at noon. The time is the *civil*, and not astronomical or nautical time.]

Sailed from Falmouth, (Jamaica,) May the 23rd, and bore away for the “Strait of Florida.”

May 30th.—Rounded Cape Antonio with a gentle breeze at E.N.E. In May, 1824, I found a current here setting with considerable strength into the Mexican Sea. This voyage there is none. I have perceived no current between the Grand Cayman and the S.W. end of Cuba; but there was a little easterly set between Jamaica and the Grand Cayman. The day we called there for turtle (the 27th) it was going to windward at the rate of one mile an hour.

June 1st.—In lat. $23^{\circ} 50'$, long. $84^{\circ} 20'$. This day we first began to feel the influence of the current from the Mexican Sea.

It is well and truly remarked, by a skilful and a very intelligent navigator, in Purdy’s ‘*Memoir of the Atlantic*,’ that “the calculations of the velocity of the Gulf-Stream are not to be depended on.” In the early part of June, 1824, it was running at the rate of $2\frac{1}{2}$ miles an hour between the Bemini Isles and Florida: in July, 1825, its velocity was 4 miles nearly; and this voyage it is rather more than four. This has been ascertained by sidereal observations, made repeatedly during the night, together with the meridian altitudes of the sun and moon.

Let us now pursue our voyage. On the 7th of June we cleared the “Strait” and stood to the northward with an easterly wind. It has been laid down as an established (and I believe an uncontroverted) position, that a rippling of the water is never seen in the Gulf-Stream, but only on its outer edge. I have no objection to receive this doctrine as a general rule; but it certainly is not an infallible indication of the edge; for I have seen it more than once in the very heart of the stream. To-day, for instance, June 9, we are in latitude $32^{\circ} 10'$, longitude $78^{\circ} 2'$, and I never saw the ocean more agitated by a current in my life.

Every now and then we get into an extraordinary boiling, like the race of a spring-tide over a shoal, and by a reference to the Chart it will be seen that we are very far from the outer edge. It is true, the boundaries of the Gulf-Stream cannot be laid down in a chart as fixed and unchangeable: the stream will be affected, both in its breadth and velocity, by causes that we know nothing of:—causes that operate to-day and may cease to-morrow: but there cannot be a doubt that these rippings I speak of are in the strength of the stream, for the ship has been swept 60 miles N. 40° E. by the current in the last 24 hours.

June

June 10th.—Wind westerly; a moderate breeze; latitude $33^{\circ} 51'$, longitude $75^{\circ} 4'$.—The current has carried us 58 miles N. 56° E. in the last 24 hours, and we have passed through four or five rippings to-day as well as yesterday.

June 11th.—Wind from S.W. to N.W.; a gentle breeze; lat. $34^{\circ} 38'$, long. $73^{\circ} 23'$. Current has set us N. 76° E. 9 miles in the last 24 hours. No ripple seen to-day.

June 12th.—Wind westerly; a nice little breeze.—To-day and yesterday very little Gulf-weed has been seen. A sprig now and then. Yesterday the current was very weak, and to-day there is none at all. On the 9th and 10th the sea was almost covered with weed, and we had then a beautiful current. It would almost appear that the weed (as well as the ripple) is but a fallacious test of this stream of streams. The truest indication is the temperature of the water. Compare the temperature of the water every four hours, and the rise or fall of the quicksilver will be a useful guide.

June 13th.—Wind from N.E. to East; a strong breeze and hazy weather; lat. $35^{\circ} 34'$.—No altitudes for chronometer—the sun was not out at a proper time from noon. There seems to be no northerly current. The dead reckoning agrees with the observed latitude.

June 14th.—Wind veering between North and East; a moderate breeze; lat. $36^{\circ} 10'$, long. $70^{\circ} 55'$. A few sprigs of weed seen now and then, and we find a little current to the N.E.

June 15th.—Light wind and very variable; between N.E. and W.N.W.—In the last 24 hours the current has set N. 66° E., 26 miles; a few sprigs of weed have been seen occasionally; lat. $36^{\circ} 34'$, long. $70^{\circ} 7'$. At 1 *p. m.* got into a prodigious quantity of Gulf-weed: the ocean covered with it for 2 or 3 miles. Passed through it in about half an hour, and during the remainder of the day saw very little: a cluster here and there, now and then.

June 16th.—Wind between N.E. and East; a fresh breeze. The courses and distance, by compass and log, give the same easting and northing as the ship has made by celestial observations. Lat. $36^{\circ} 52'$, long. $68^{\circ} 45'$: we still pass sprigs of Gulf-weed.

June 17th.—We have been standing to the northward since yesterday morning at 8 o'clock, with the wind about East, and are now in lat. $37^{\circ} 50'$, long. $68^{\circ} 50'$ at noon. The log gives a true North course, and the chronometer gives 5 minutes of westing, therefore we may presume there is little or no current, for the latitude, by dead reckoning, agrees within a mile of the observation. *P. M.*—I find by altitudes, taken this afternoon at 5 o'clock, that the ship has made 17 minutes of easting by chronometer since the sights I took in the morning at 9. We must be getting into the stream again, for the ship has not made a single mile of easting, by fair calculation, according to dead-reckoning. A few sprigs seen to-day.

June 18th.—The wind has been steady at East all the last 24 hours, and we have been standing to the northward all the time. These currents of the ocean are puzzling phenomena! The true course and distance by log is N. $\frac{1}{2}$ W. 50 miles; and what course do you think we have really and truly made by celestial observations? By the meridian altitude of the sun, our lat. is $38^{\circ} 7'$, and the longitude, by chronometer and lunar, $67^{\circ} 46'$. So we have made 17 minutes of northing, whereas the run by log gives $50'$: and we have made 64 minutes of easting, when the most skilful seaman, without a knowledge of lunars or chronometer, would say we have made $5'$ or $6'$ of westing. This sweep of the current I fancy we must attribute to the combined action of two streams: one, the Gulf-stream, pursuing its ordinary course to the eastward; the other, perhaps, from the St. Lawrence, running to the south. Hove a bottle overboard at noon, with our latitude and longitude, and a memorandum requesting that it might be communicated to the Secretary of the Admiralty, or to the Editor of the Memoir of the Atlantic.

June 19th.—Southerly wind with foggy miserable weather. No altitudes for chronometer or latitude. By log we are in $38^{\circ} 45'$ N., and $66^{\circ} 6'$ W. at noon.

June 20th.—The same sort of weather as yesterday, with a moderate breeze from the S.S.E. By log we are in $39^{\circ} 59'$, and $63^{\circ} 16'$. *P. M.*—Passed some weed; long and stringy; not Gulf-weed.

June 21st.—The wind drew round to the eastward last night, and we stood to the northward. At 1 *a. m.* the sky brightened, and I was lucky enough to get an altitude of the moon, when she was just on the meridian, which made the latitude $41^{\circ} 15'$; being 36 miles farther North

North than the lat. by account, since the observation on the 18th. Tacked and stood to the S.S.E. There has been very little current to the eastward since the longitude was ascertained on the 18th: the log gives nearly as much easting as the chronometer. Latitude $40^{\circ} 59'$, longitude $62^{\circ} 40'$. We have seen a good many clusters of Gulf-weed to-day. As we approach the usual northern limit of the stream, I am watching the weed particularly to see how far we shall carry it.

June 22d.—The wind E.N.E. blowing hard with a high sea and dark dismal weather: but we got the meridian altitude of the sun; and also sights for the chronometer this morning at 9 o'clock. The longitude was then $61^{\circ} 52'$, therefore we are decidedly in a fine easterly current. The log cannot possibly give a single mile of easting, for we have been lying-to, under the main topsail, in a heavy gale of wind, all the 24 hours, with our head to the southward and eastward. The ship has also been carried to the North by the current: our lat. is $40^{\circ} 45'$. So that she has really made 48' of easting, and only 14' of southing, and the log gives 38' of southing, and 6' of westing. Making every reasonable allowance for the inaccuracy of dead-reckoning, we may safely say the current has set us upward of 40 miles in a N.E. by E. direction. No one can have less faith in dead-reckoning than I have, but, still it is necessary to attend to it, in order to compare it with the ship's true position; for I am not aware of any other means to determine the set and velocity of a current, in a gale of wind, but by comparing the common calculation by log, with the true place of the ship indicated by celestial observations.

By the bye, it may be as well to remark here that, although my longitude by chronometer is generally reduced to noon in this journal, in accordance with the ordinary practice, a more correct way is certainly to reckon from the longitude when the sights are taken; for the interval between the altitudes and noon must be filled up by dead-reckoning; and, if there should happen to be a current, the longitude, of course, may be affected by it. *P. M.*—At 5 o'clock, by chronometer, we have still a fine current. No weed seen all day.

June 23d.—Wind E.N.E. Still blowing hard: but less sea, and wind abating. Ship's head to the S.E. Lat. $40^{\circ} 1'$.—*P. M.* Fine weather again. Made sail. At 4h. 30m. got altitudes for chronometer, and I am sorry to find we have lost the current. The longitude is $61^{\circ} 57'$. Tacked ship immediately and stood to the northward. We have passed some weed to day, both in large clusters and small sprigs.

June 24th.—The wind came round to the S.S.E. in the night, and we shaped a course E. by N., with a light breeze. The longitude, by chronometer, this morning at 8 o'clock, disappointed me very much: at 4h. 30m. *p. m.* yesterday, it was $61^{\circ} 57'$, and we have been standing to the eastward almost all night. The log makes it $61^{\circ} 18'$, and the chronometer $61^{\circ} 45'$! We have had a westerly set undoubtedly; and a southerly one too, for the lat. is $40^{\circ} 9'$, and by the log it should be $40^{\circ} 16'$. A few sprigs of weed in sight to-day. *P. M.*—Chronometer (at 5 o'clock) gives 5 minutes of easting more than the run by log, since the altitudes in the morning at 8.

June 25th.—Wind South; a gentle breeze and fine weather. Lat. $40^{\circ} 18'$, long. $60^{\circ} 8'$. No perceptible current these last twenty-four hours. Passed several sprigs of weed.

June 26th.—Wind southerly, a steady 6 knot breeze and fine weather. Steering E. by S. Lat. $41^{\circ} 3'$, long. $56^{\circ} 46'$. Ship has gone 138 miles by log, and 155 by chronometer. The difference between chronometer and dead-reckoning must not always be attributed to a current. Some allowance must be made for the carelessness of sailors (especially in the night watches) at the helm, and other circumstances relating to the run by log. However, I think I am warranted in saying we have benefited something by a current. I make it N.E. by E. 10 or 12 miles. *P. M.*—The chronometer tells me (at 6 o'clock) that we have an easterly current.

June 27th.—A moderate breeze at S.W. Running E. by S. Lat. $41^{\circ} 27'$, long. by lunars and chronometer, which differ very little, $53^{\circ} 41'$ at noon. Current has set us N. 62° E. 26 miles in the last 24 hours. *P. M.*—Two sprigs of Gulf-weed this afternoon, in lat. $41^{\circ} 29'$, long. $53^{\circ} 8'$.

June 28th.—Steering E. by S. with a gentle 4 knot breeze at S.W. The longitude, by chronometer, was $52^{\circ} 11'$ this morning, and we made 11' by log between that time and noon. So we shall call the long. $52^{\circ} 0'$, and the lat. $41^{\circ} 50'$. We have had a little northerly set these last 24 hours, 8 or 9 miles North, and 2 or 3 miles East. I have observed, in my last three voyages from Jamaica, that we have always felt a northerly current of some strength

strength in this part of the ocean, setting toward the Bank of Newfoundland, in June and July. This, if I mistake not, is contrary to the generally received opinion. Some weed in sight to-day; a few sprigs decidedly Gulf-weed: they had all the well-known characteristics of the regular Gulf-weed: but there was some of a different kind, with stringy long stems.

June 29th.—A light breeze from the southward with foggy "*Bank Weather*," as the sailors call it. Steering E. by S. At 8 o'clock this morning it cleared away, and I took altitudes for my chronometer, which made the longitude $49^{\circ} 42'$; and, at the same time, we discovered an island on the starboard beam, 3 or 4 miles off. Shortened sail, hove the ship to, and sent the mate to see what it really was; for, although I had no doubt of its being an iceberg, yet it certainly looked something like land; and I did not wish to leave it in any kind of uncertainty. The fog, which had cleared away at 8 o'clock, and left a beautiful blue sky, returned suddenly when the boat was about half way from the ship. The mate, an active skilful seaman, had a compass with him, and he apprehended no danger, but pushed on for the island instead of returning when he saw the fog spreading. Hour after hour passed away, and no appearance of the boat. Night came on, dark as the grave, with a cold benumbing drizzle, and a fog so dense that we could scarcely see across the deck. My grand object was to keep the ship as near the same spot as possible. All day and all night we kept the bell tolling, and fired a great gun occasionally: a tar barrel was also blazing at the main-yard arm, but all was unavailing. I shall never forget the terrors of that night. I reproached myself as the cause of their destruction; and I prayed most earnestly for day-light and clear weather. I thought day-light would never come; but it came at last, and the fog was thicker, if possible, than the day before. The most sanguine now began to despair. About 5 o'clock something was heard, like the blowing of a conch shell, but so faint and indistinct that we thought it was only the echo of the great noise we were making on board. However, it was soon discovered that the sound was coming nearer and nearer, but, as no person on board knew that they had a shell in the boat, we were still in a sad state of anxiety, for it might, perhaps, be a ship sounding her shell in the fog, as usual at sea. In a few minutes the splash of oars was heard, and in 5 minutes more the boat was alongside with all hands safe and sound, thank God! but cold and hungry enough. The mate tells me he rowed round the iceberg, which he thinks was about 300 feet in length, 150 in breadth, and 40 or 50 feet above the surface of the water. It was melting away rapidly: streams of water were gushing down its sides, and they had only got a few yards from it, on their return, when (to use his own words) "it took a sally and fell over on its beam ends." Our last sight of the ice, when bearing S.W. 3 or 4 miles, was in lat. $42^{\circ} 13'$, long. $49^{\circ} 44'.$ *

June 30th.—Light breezes from the westward. When the boat returned this morning made sail again on the same course, E. by S. At noon, atmosphere thick as melted butter. No sights for chronometer or latitude, and I was in too much distress to attend to latitude or longitude by dead-reckoning.

July 1st.—Westerly wind, with thick fog, generally, but clearing away now and then during the day, so that I got a glimpse of the sun this morning for the chronometer, and also a good meridian altitude for the latitude. I was even lucky enough to get three sets of lunar distances. I worked them all separately, as well as by the mean of the three sets, and they differed only 2 miles. The lunar is $16'$ to the eastward of the chronometer, but I rely more on the chronometer than the lunar. Latitude $42^{\circ} 46'$, chronometer $47^{\circ} 11'$ at 9 a.m. Immediately after noon the fog returned with all its density.

July 2d.—Wind westerly. Light breeze; 3 or 4 knots.—In confirmation of my position that a ship makes more northing than the log will give, near the Bank of Newfoundland, in this season of the year, (my remarks have been made in June and July only,) I find we have made 28 or 30 miles of northing more than the dead-reckoning can account for satisfactorily since noon yesterday. The water is smooth, and we have been steering one course E. by S. $\frac{1}{2}$ S. with a fair wind: by log we have gone 82 miles, and I think the ship has been attended to as carefully as one can expect in a merchantman. The chronometer also gives more easting than the run, by a very great deal. It cleared up about 12 o'clock, and gave me the meridian altitude: latitude $43^{\circ} 31'$. And it brightened again at 3 p.m., when my chronometer gave $44^{\circ} 6'$. The current is unquestionably going to the

* On the 18th of June, 1839, an iceberg was seen, supposed to be about a mile in length, and from 50 to 70 feet high, in latitude $40^{\circ} 50' N.$, and longitude $48^{\circ} 39' W.$ (*Naut. Mag.*, Nov. 1839.) northward

northward and eastward. I make it N. 61° E., 48 or 50 miles since 9 o'clock yesterday, when the longitude was found by chronometer.

July 3d.—Steering E. by S. $\frac{1}{2}$ S. Wind westerly, a nice little steady breeze.—Longitude, by chronometer, this morning, at 8h. 24m. was $41^{\circ} 44'$; and the latitude $43^{\circ} 58'$. Current has set us N. 73° E. 17 or 18 miles in the last 24 hours. (See page 226.)

July 4.—Wind westerly, a beautiful breeze. Running E. by S. $\frac{1}{2}$ S.—It is my constant practice to take sights for the longitude two, three, or four, times a-day, according to circumstances, as well as sidereal observations, for the latitude, in the night watches; and by these means, I think it is a fair conclusion that I can discover, generally, the set and velocity of a current very soon after the ship begins to feel its influence. Now, as the current has been setting altogether to the eastward during the last 24 hours, (N. 85° E. 10 miles,) the longitude only will be disturbed, therefore the chronometer will be our truest guide, and she tells me that the current ceased in lat. $44^{\circ} 16'$, long. $38^{\circ} 32'$. This I call the eastern boundary; or rather the termination of the Florida Stream: and under that impression I turned a bottle adrift with a memorandum: some curious and perhaps useful knowledge, relating to the currents of the ocean, may possibly result from experiments of this kind. I dare say I have tried it 50 times, but I never heard of any of my bottles being found. I saw some bunches of weed to-day: it was decidedly what is commonly called Gulf-weed: the same kind that we meet with in the Florida Stream, along the Coast of North America, but it had not the same flourishing look. I call them bunches in contradistinction to sprigs, for, the sprigs that we fall in with to the southward float lightly on the surface, but these to the northward are more like bunches of oakum: bunches of oakum, saturated with water, and almost sinking.

July 5th.—Wind W.N.W. A fine steady breeze. Running E. by S. $\frac{1}{2}$ S.—Lat. $44^{\circ} 53'$, long. $35^{\circ} 45'$. I have no doubt that the weed mentioned yesterday was at the eastern end of the stream, for we have seen none since, and none was seen for two days before: and the run by log gives now as much longitude as the chronometer. I fancy we may presume that the weed was carried there by the Florida Current, unless, indeed, we adopt the hypothesis that the current has nothing to do with it: that it grows and ripens at the bottom of the sea; and, when in a state of decay, the stems are broken off by the agitation of the water, or some other accidental cause, and then it comes to the surface. Be that as it may, the weed, in this part of the ocean, I have invariably found in a perishing state; and I have generally found it fresh and healthy in the stream sweeping along the Coast of America.—See the description of the SARGASSO SEA hereafter.

[From the 6th to the 14th of July, when the ship arrived at the Lizard, the Journal presents nothing remarkable, excepting a current setting N.W. by W. on the edge of soundings, as already noticed in page 163. The current on other days was scarcely perceptible.]

2.—REMARKS ON THE NAVIGATION OF AND FROM THE WEST-INDIES, PARTICULARLY WITH REGARD TO CURRENTS, &c., BY CAPT. T. WILSON, 1824-5.

At the beginning of October, 1824, Captain T. Wilson, in the ship *Henry Wellesley*, after touching at Madeira, was on his passage from MONTERRAT to CARTAGENA, and he says, “We found the currents setting to the eastward until we reached the meridian of 70° W., and in one twenty-four hours found the observed latitude to be 30 miles to the northward of account. After passing 70° W. and 14° N. we experienced westerly currents.

“In afterward running down from CARTAGENA to HONDURAS, in lat. 11° N. and longitude, by bearing of the land, $75^{\circ} 45'$ W., tried the current, and found it to set E. by S. three-quarters of a mile in an hour; and found, in the following twenty-four hours, the observed latitude to be 8 miles to the southward of latitude by account.

“On the 5th of October, steering N.W. and keeping a look-out for the SERRANILLA, at 2h. 30m. p.m. saw broken water, with a bright yellow sandy reef, from the fore-top-gallant-mast-head, then bearing N. by E. and at the estimated distance of 9 or 10 miles.

“The observed latitude on the previous noon was $15^{\circ} 25'$ N., and the distance run, by log, from that time until the reef came in sight, was 8 miles, on a N. $\frac{1}{2}$ W. course; allowing this, with the distance, adding two miles for northerly set, as found in the previous 24 hours, will give a corresponding latitude of the reef, as laid down in the *Colombian Navigator*, $15^{\circ} 45'$ N.

“Continued the course at N. $\frac{1}{2}$ W. true, but, at 4 p. m., saw rocks and broken water on the

the larboard-bow, bearing N.W. $\frac{1}{2}$ W. about $2\frac{1}{2}$ miles; the sandy reef at the same time bearing N.E. by E. $\frac{1}{4}$ E., at 11 or 12 miles, not being visible below the mizen-top.

"The rocks appeared to range about one mile and a half from N.W. to S.E. and lie at about one-third of the length of the reef from the western end of it. They showed themselves about 5 feet above the water: the remaining part could be discerned only by the sea's breaking over it. In the space between the sandy and the rocky reef there was no appearance whatever of broken or discoloured water.

"At 5h. 30 m. p. m. the broken water on the sandy kay was barely to be seen with the spy-glass from the mizen-top, and bearing E. $\frac{1}{2}$ S., and the rocky reef bore, at the same time, N.N.E. about two miles. At 6 p. m. the rocky reef bore E. by N. a short two miles; sounded in 7 fathoms, with a white coral bottom. With the reef bearing S.E. $\frac{1}{4}$ E. $2\frac{1}{2}$ miles, had 9 fathoms. With the broken water barely in sight from the mizen rigging, and bearing S.S.E. $\frac{1}{2}$ E. sounded in 12 fathoms. At 7, had again 12 fathoms: the ship, during all the time of sounding, going at the rate of 5 knots. At 7 h. 30 m. p. m. had 16 fathoms; and at 8, no bottom, with 50 fathoms up and down. The quality of the soundings continued the same all throughout as at the first cast.

"The dangers of the Serranilla, as described and exhibited in the charts, leave no doubt that the shoal requires much caution.

"Ships from the southward, from which quarter the reef is most likely to be approached, must be very cautious in passing its latitude in the night, however certain they may be of the longitude: for the kay, and in particular the reef, are so very low, that there would be very little chance of seeing it in the night before experiencing its ill effects. Should a ship happen to make the sandy kay first, it is recommended to keep a good look-out to the westward for the rocky reef; for although there may be no visible dangers, some may exist, which will make it imprudent to attempt the passage until it is better known.

"The moon's distance, from two stars at 8 p. m. the same evening, gave a mean longitude of $80^{\circ} 23'$ W. Allowing, therefore, 6 miles westing from 5h. 30 m. p. m. when the sandy reef bore E. by S. *true*, (estimated distance 4 leagues) and 12 miles westing for that bearing, will place the body of the sandy kay in $80^{\circ} 5'$ W.*

"The ship was found, by observation, to be considerably to the northward, both on the day of making, and the day after passing, the reef; supposed to be from a N.W. current; and the dead-reckoning, in five days, from 76° to 80° W., and from 11° to 16° N.

"After passing the intersection of 82° W. and 17° N., found a current which set 13 miles, by difference of observations, in 7 hours.

"After taking a departure from Ruatan for the Southern Four Keys, experienced a S.E. current; arising probably from taking the departure too far to the westward of Ruatan, it bearing at the time, by compass, East Point S. 82° E. and S.W. Point S. 13° W."

REMARKS MADE ON THE PASSAGE FROM THE BAY OF HONDURAS, THROUGH THE STRAIT OF FLORIDA, TOWARD ENGLAND, 1825.

"LEFT MAUGER KAY at 7 a. m. January 22, and at noon observed the latitude to be $17^{\circ} 54'$, which was 12 miles to the southward of dead-reckoning.

"For four days after the 22nd, we stood off to the eastward with strong norths; and, on reaching in to the westward, on the 5th day, made the TRIANGLE, which showed the dead-reckoning to be 90 miles too far to the eastward; and it was remarkable that, during the period, there was no deviation found in any one of the days between the latitude by account and observation: from this circumstance, a caution to a ship, under similar circumstances, may not be useless; for inattention to it may prove fatal to a ship standing in during the night, which at the time may be supposed to be 100 miles off the danger.

On the 29th of January, at noon, the Island COSUMEL bore N. by E. by compass, distant at least 4 leagues; being to be seen only from the mizen-topmast head. The latitude, at the same time, was observed to be $20^{\circ} 2'$ N. The south end the next day bore West, and the observed latitude was $20^{\circ} 16'$.

From latitude 20° and longitude 87° to $22^{\circ} 30'$ and 85° we experienced strong north-

* The eastern extremity, according to the late surveys, is in $79^{\circ} 41'$ W., the middle of the southern kays in $79^{\circ} 55'$, and the western extremity of the bank, $80^{\circ} 5'$ W.

erly currents, and in one twenty-four hours the latitude differed 42 miles. This was from latitude 21° to $22\frac{1}{2}^{\circ}$ N.

In lat. 24° N. and long. 87° W. found a northerly set of 32 miles in nine hours. The difference of latitude was ascertained by meridional observations of stars.

IN THE STRAIT OF FLORIDA, from lat. 24° to lat. 25° , about longitude 80° , we experienced the usual velocity of the currents, as laid down in the charts: that is, about $3\frac{1}{2}$ miles an hour toward the N.E.: but, after reaching 25° N. the current seemed to set nearly due East toward the Bahama Bank. From 25° to 26° the difference of latitude, ascertained by observation, exceeded the run by log 31 miles northing; this was in an interval of 15 hours. From latitude 26° to 28° , in an interval of thirteen hours, the difference of latitude by observation exceeded the difference of latitude by dead-reckoning by only 32 miles.

From latitude 25° N. the usual velocity of the current, as marked in the chart, was carried on with the dead-reckoning until the latitude was again accurately ascertained by the sun, when the dead-reckoning, with this allowance, exceeded the observed latitude by 116 miles; that is to say, the latitude by log, with the usual allowance, was $29^{\circ} 58'$, but the observed latitude only $28^{\circ} 2'$ N.

This remark may not be unworthy of notice; for, supposing the weather not to admit of an observation, all through the Strait, to ascertain the latitude, it may serve to warn a ship, under such circumstances, not to haul out too soon to the eastward, without having run well to the northward, so as to give a good berth to the Maternillo Reef, on the consideration that the stream may have set them sufficiently to the northward: for had we, in the *Henry Wellesley*, trusted to our latitude by log, after having made the usual allowance, we should have endangered the ship on the Maternillo; but having ascertained our latitude by sidereal observation, it warned us of our error, and may serve to show the great utility of finding the latitude by night as well as by day, in this dangerous and critical navigation.

In running from the Strait toward Bermudas, no easterly current was experienced; on the contrary, in an interval of eight days, our observed longitude differed with longitude by log by about 40 miles to the westward: but this may have arisen from errors in the log.

10. ON THE GENERAL CAUSES OF THE CURRENTS, &c.

"It is well known how easily a current may be induced by the action of the wind, and how a strong S.W., a N.W., or even a N.E., wind on our own coasts raises the tide to an extraordinary height in the English Channel, the River Thames, the East Coast of Britain, &c. as those winds respectively prevail. The late ingenious Mr. Smeaton ascertained, by experiment, that in a canal of 4 miles in length, the water was kept up four inches higher at one end than at the other, merely by the action of the wind along the canal. The Baltic is kept up 2 feet at least by a strong N.W. wind of any continuance; and the Caspian Sea is higher, by several feet at either end, as a strong northerly or southerly wind prevails. It is likewise known, that a large piece of water, 10 miles broad, and generally only 3 feet deep, has, by a strong wind, had its waters driven to one side, and sustained so as to become 6 feet deep, while the windward side was laid dry. Therefore, as water pent up so that it cannot escape acquires a higher level, so, in a place where it can escape, the same operation produces a current, and this current will extend to a greater or less distance, according to the force by which it is produced or kept up by the wind."*

These facts are so well ascertained, that it may generally be taken for granted, a certain degree of current will obtain on the Atlantic, after a continuance of any uniform wind, where the sea would be otherwise in a placid state, and unaffected by other causes. For,

* Major Rennell, on the Thwart Channel-Current. It has furthermore been noticed, that the effect of wind in altering the level of the surface of water, is strongly exemplified in the reach which forms the summit-level of the Forth and Clyde Canal in Scotland. This reach is about 18 miles long, nearly in a straight line, East and West. When a westerly gale has blown for some time, the action of the wind sweeps away the water from the west end, sinking its surface, and accumulating it at the east end, where it escapes over the lock-gates, in a stream sometimes ten inches deep.—*Ed. Ph. Journ.* Vol. 6, p. 71.

In a gale of wind, in 1823, a part, or *Reach*, of the *Grand Junction Canal*, was raised 21 inches.

The effect of S.W. and southerly winds, on the level of the sea upon the Coast of Guinea, has been shown in page 148.

it is supposed, that, the winds, where uniform and permanent, produce currents equally uniform and permanent. Hence it is, that the winds between the tropics, having a general course westward, protrude the water of the Atlantic in the same direction, and cause the flow of a current the same way, unless where it meets with land, islands, or shoals, to obstruct its course or change its direction, or where it runs through channels which draw it a different way.

There is reason for believing that the great currents within the torrid zone are increased by the influence of the moon, which draws them on from East to West. One instance that currents are affected by this cause, is, that, in the Faro, or Strait of Messina, between Sicily and Calabria, in the Mediterranean Sea, where there is *no rise nor full*, a current sets to the northward and southward alternately, for six hours, having every appearance of being governed solely by the lunar influence. Other instances might be given; and there is little doubt but the power of the winds is blended with the attraction of the moon in forming the currents which set westerly from the Atlantic into the West Indian sea.*

In the year 1804, Captain James Manderson, of the Royal Navy, published "An Examination into the true cause of the Stream of Florida," &c. In this treatise he considers the floods of the Mississippi as the 'prime mover of the Florida Stream;' and he presumes that it is caused by the waters which fall into the Gulf from that and other rivers. Captain Livingston, on the subject, says, "From the best information I could obtain, relative to the quantity of water discharged into the sea by the Mississippi, Rio Bravo, &c. &c., there seems no probability that, in the aggregate, they exceed a three-thousandth part of the water which is discharged through the Strait, between the Florida Reefs and the Bemini Kays, or the narrowest part of the Strait."

Upon the hypothesis of Captain Manderson, it was subsequently stated, in an American work, that the velocity of the Gulf-Stream might be calculated by the *rise and fall of the floods in the Mississippi*. Thus is one error propagated upon another! "I have," adds Captain Livingston, "experience of the contrary. In August, 1818, the river Mississippi was *uncommonly low*, and I never saw the Gulf-Stream run with greater velocity. The trade-winds raising the level of the Gulf of Mexico seem to me the principal cause of the Gulf-Stream.

"I am of opinion that its velocity depends on the motion of the sun in the ecliptic, and the influence he has upon the waters of the Atlantic: as, when the sun's declination is North, the N.E. trade-wind blows fresher, and extends farther to the northward than when the sun's declination is South. This causes a greater pressure of water toward the Caribbean Sea, and a superior elevation of the surface of the Gulf of Mexico, the superfluous water of which escapes by the Strait of Florida, where it is least opposed by the trade-wind, which only affects it laterally, (except in the short distance between the Dry Tortugas and the Salt-Kay Bank,) and even there the effects of the trade-wind must be very much diminished by the Bahama Bank, with the islands and kays thereon.

"There can be little doubt that the attraction of the sun, while in the northern hemisphere, influences the current which generally prevails about Madeira, and causes it to set with greater velocity toward the southward and eastward. One well-known fact seems to corroborate this idea, namely, that the above-mentioned current is always much stronger in the summer than in the winter months. On a reference to my journals it appears that, although we were a considerable time in the limits over which the influence of the Gulf-Stream generally extends, that in the forenoon of Friday, the 19th, and on the whole of the 20th of February, we felt its effects in a slight degree only; the water appearing, during that time, to have been perfectly stationary. It may, also, be remarked, from the journals of my voyage through the Strait of Florida, in September, 1818, in the ship *Asia*, and in March, 1819, in the brig *Dispatch*, how very little we gained, in the latter instance, from the assistance of the stream, when compared with the manner in which it hurried us to the northward on the former. All this tends to confirm me in the opinion, that the velocity of the Gulf-Stream depends almost entirely on the sun's place in the ecliptic."—A. L.

It may here be remarked, that the Gulf-Stream is augmented during the rainy season of

* Particular convulsions in the interior of the earth sometimes occasion an extraordinary derangement of the tides, &c. After a late occurrence of this nature in the Mediterranean Sea, called by the Italians a *sea-earthquake*, the course of the tides in the Gulf of Spezzia was totally deranged for the seven or eight succeeding days. But the ebb and flood were sensibly perceived at intervals of a quarter of an hour, half an hour, and an hour, during that whole space of time.

the West Indies; and reaches its highest parallel, (about 43° N. between 56° and 57° W.) in the summer only. In that season it there spreads over a vast extent of the oceanic water. It is also to be recollected that, in the same rainy season, the waters of the Caribbean Sea, which is then surcharged, seek an escape along the Colombian coast to the eastward, as well as by the Channel of Yucatan to the west.

The EASTERLY CURRENTS in the *Northern part of the Atlantic*, and which, in the Bay of Biscay, exert their tremendous effects, so as to be proverbial, originate in the north, as we have described, and then conform to the winds, which, in these regions are, as already shown, mostly from the N.W., and violent during a great part of the year.

The more general prevalence of westerly winds off the coasts of the United States operate to produce a depression of the water off those coasts; and, of course, contribute to an easterly tendency in the waters of the ocean.

The indraught into the Strait of Gibraltar is attributed to the evaporation of the Mediterranean Sea, which appears to be the cause of the currents setting immediately in that direction, and of biasing the water from the west.*

These circumstances, combined, must indisputably produce the set or drift of a great portion of the Atlantic to the East, E.S.E., and S.E., which, however, varies with the winds, with the seasons, and local circumstances.

The auxiliary winds on the African coast are the mean of continuing and carrying it down that coast in the manner in which it has been described.

To the prevalence of westerly winds and easterly currents is to be attributed the shorter period of voyages from America to Europe than from Europe to America, a fact established by general experience.

At any considerable distance from the Coast of America, the easterly current, caused by the action of violent West or N.W. winds, is seldom felt to the southward of latitude 36° ; consequently, the sea about the Bermudas, and thence southward, is free from the influence of this current. The currents here, though slow, are produced in the direction of the wind, particularly when it is of long continuance. These currents are found stronger near the islands and rocks of Bermudas than at a distance, because the obstruction which the water meets with from the islands causes it to run proportionably faster past their sides. In a brisk gale, the current here has been experienced from 12 to 18 miles in the 24 hours, in the direction of the wind; at other times, when the wind was not settled, no current has been found.

To continued westerly winds are to be attributed the common occurrence of a passage from Halifax to the English Channel in 16 or 18 days, with such currents as those which carried the bowsprit of the Little Belt, sloop of war, lost near Halifax, to the entrance of Basque Roads. The currents of the Atlantic have sent to the shores of the Hebrides the products of Jamaica and Cuba and of the southern parts of North America; but we know not the courses, or tracts, through which these articles may have been impelled, nor the spaces of time in which they were afloat: all this is conjectural, and furnishes matter for investigation. We still, as already noticed, require DATA, or a more extensive knowledge of facts.

Lastly, *Major Rennell* is of opinion, that those transient and contradictory currents, that are met with in the mid-ocean, are owing to gales of wind, which sometimes are but narrow in their column of air, but affect the surface very strongly so far as they extend.

IV.—OF THE PASSAGES OVER THE ATLANTIC.

I. OF SHIPS BOUND TO AND FROM THE EAST-INDIES, &c.

M. D'Après de Manneville, in his Directions for navigating from the English Channel to the East-Indies, says, "When you steer out of the Channel, you ought to shape your

* This was the opinion of Dr. Halley, which has been controverted by those who suppose that the effect may be accounted for by the motion of an under-current, setting outward. The flood-tide, on either side of the Strait, does certainly set outward, but the ebb sets inward with the general current. See the remarks on the Tide of the Strait, page 147. The easterly indraught appears to commence at about 100 leagues West from the mouth of the Strait.—See upon this subject our *New Sailing Directory for the Mediterranean Sea*.

course so as to pass Cape Finisterre at the distance of 25 or 30 leagues : this distance," he adds, " will be sufficient, in whatsoever season of the year your voyage may happen : you may, indeed, double that cape still nearer, if circumstances require ; but, from its latitude, you should always shape a course for the island of Madeira.

" Though a sight of that island is not indispensably necessary in this passage, it is proper, however, to gain a sight of that, or of the island of Porto Santo, that you may be able to keep on your course afterward with greater certainty, whether you pass between the Canary Islands, or leave them to the eastward, as may be judged most convenient."

The reason of doubling Cape Finisterre at the above-mentioned distance is, that you may not be embayed by wind or currents within the Bay of Biscay. The distance, in rounding the cape, may be from 20 to 50 leagues. With a westerly wind, give it sufficient offing ; or, in hazy blowing weather, it may be dangerous to stand to the southward in the night. See the remarks on Currents, pages 153 to 176, &c.

Gales from W.N.W. have frequently continued to blow into the bay for several days successively. Several outward-bound East-Indiamen have been driven far into it, in April and May ; and, should a ship in this situation lose her masts, and be driven on a lee-shore, the consequence would be dreadful.

Modern navigators who have chronometers, prefer passing to the westward of Madeira, instead of steering for that island, at any convenient distance, beyond 7 or 8 leagues. Thus they generally have steadier winds ; particularly in winter. In November, December, and January, westerly gales prevail here, which produce eddy-winds and severe squalls near the land, occasioned by the high land's obstructing the regular course of the gales ; and, besides, the weather here is very precarious.

M. D'Après goes on, " In the passage from the Coasts of France to the Canaries, you may frequently find differences in your reckoning to the eastward, which arise most probably from the indraught of the currents toward the Strait of Gibraltar : some have made the land on the Coast of Africa when they expected to have discovered Tenerife ; others have gained sight of Allegranza, off the northern part of Lanzarote, instead of Tenerife ; and, though the errors in reckoning may not frequently be so considerable, yet it is safer to be on your guard, when you judge, by your reckoning, that you are in the latitude of these islands, especially in the night-time, or when the want of moonlight, or very thick hazy weather, prevents you from discovering dangers at such a distance as to be able to escape them.

" The differences to westward, though much more rare, are yet not without example ; chiefly when the winds have hung contrary for some time after the departure from the ports of England or France."

Ships are, however, now generally recommended to pass to the westward of the Canary and Cape Verde Islands : it having been found, that, in this route, steadier winds may be expected than those generally prevalent close to or among the islands. On the African Coast, W.S.W. and S.W. winds are frequent. The track now generally adopted, by ships having chronometers, is that to the westward of all the islands.

Should it be required to touch at Senegal or Goree, the best course will be, to make the Coast of Africa near Cape Blanco, latitude $20^{\circ} 55'$; as there are soundings at 5 or 6 leagues off the coast, and no danger in making the land, either by day or night, provided the lead be kept frequently going : and thus you may steer up to the Cape.*

" Though it may seem natural enough not to suspect any errors of consequence in your reckoning in so short a passage as from the Canaries to the Isles of Cape Verde, yet there are instances of such, as well to easting as to westing. It is with respect to errors in our westings, that I advise all vessels to keep 30 leagues to windward of Bonavista, before they stand in to make the land ; lest, in keeping a direct course for that island, they should pass between the Isle of St. Nicholas and the Isle of Sal ; and, finding themselves to westward of Bonavista, when they reckoned themselves to be still to eastward of it, they should miss of their refreshments at the Isle of St. Iago, an accident which has happened to several vessels.

" The making of these islands is often difficult, occasioned by the fogs, which hang

* Directions for proceeding hence, southward, will be found in the next section.

frequently around them. From this reason, those who come from the northward, ought to steer their vessels in this track with all possible precaution.*

“The most convenient course for vessels, which continue their voyage from the Canaries, without touching at the islands of Cape Verde or Goree, is to steer, after they lose sight of the Canaries, so as to pass about 45 leagues West of Cape Blanco (or near the meridian of 20°); from this position they will make good their course due South, as far as to 12° N., and afterward S.E. by S., till they meet with those variable winds which succeed to the trade-winds. By this they will keep the mid-channel between the Islands and Cape Verde, and coast along the bank below that cape, at a sufficient distance, even though they should make an error in their reckoning of 15 or 20 leagues to eastward.” (*But see Major Rennell's Remarks, page 180.*)

But as, when the sun is near the northern tropic, the trade-wind has been often found to fail within sight of the Cape Verde Islands, it has been recommended to ships, at these times, to pass the islands to the westward, at the distance of about 10 leagues, in order to preserve a steady wind, and prevent delay, by keeping clear of the light eddy-winds which then prevail near and among the islands. When to the southward of these isles, steer to the S.E., so as to get between the meridians of 18° and 23° W., upon losing the N.E. trade-wind. Should the southerly winds then commence, advantage may be taken of the shifts to stand on the tack which will gain most to the southward, and so as to cross the equator between the longitudes above-mentioned, if the winds will permit. Be cautious of making a long tack, either eastward or westward, with a dead southerly wind, in hope of having a better, unless the wind should veer, so as to produce much southing.

The S.E. trade-wind, at its northern limit, generally inclines far to the southward, particularly in July, August, and September, but frequently in other months. A ship, meeting this trade, should not be kept too close to the wind, but kept clean full, in order to make good way to the S.W., and clear of the southern limits of the westerly current that generally prevails about the equator.

It has been already shown, in the description of Currents, that ships, passing the line too far to the westward, run the risk of not being able to weather the Coast of Brasil. But *M. D'Aprés* has observed, that there is not one instance to prove that, by passing the line to the eastward of the limits above-mentioned, ships meet with calms of a long duration, and currents setting with great rapidity toward the River Gaboon, as had before been generally imagined. His opinion has been corroborated by *M. la Perouse*, whose remarks on the subject are heretofore noticed. (Page 97.)

M. D'Aprés adds, “Vessels which sail from St. Iago should steer S.E. as far as the 12th degree of latitude: after that, S.E. by S. Those which depart from Goree should steer S.S.W., if they desire to keep clear of the coast, till they reach the parallel of 10 degrees; thence their course should be S.E. by S.”

His words, on crossing the line, are, “When the variable winds succeed the trade-winds, the best method of crossing the line with speed is, to take advantage of the very first variable winds, for gaining the ordinary track of the general winds so soon as you possibly can; and, for this end, to keep indifferently to that tack which bears most to southward, without troubling yourself about crossing the line at any determinate point, lest you make your voyage longer than is necessary.”

Captain *Geo. Cheveley* has said, “I think July may be considered as the worst month of any to get quickly across the line to the southward. I sailed from Liverpool two summer voyages in succession; the one in twenty-five, the other in thirty, days, to the Equator. I then lost the N.E. trade in 11° and 12° N. and experienced for three weeks nothing but S.W. winds, blowing hard squalls, and gales of wind, with torrents of rain; with which I had also to contend against a strong northerly current [the Equatorial] of at least one mile an hour.” See the description of Currents, page 190.

Let us endeavour to enliven our subject, by some reflections from a volume of the Baron Alexander de Humboldt.

“From the time,” says *M. de Humboldt*, “we entered the torrid zone, we were never wearied with admiring, every night, the beauty of the southern sky, which, as we advanced

* See Remarks on the rocks supposed to lie to the eastward of Bonavista, in the Directions for the Cape Verde Islands, hereafter.

toward the South, opened new constellations to our view. We feel an indescribable sensation, when, on approaching the equator, and particularly on passing from one hemisphere to the other, we see those stars, which we have contemplated from our infancy, progressively sink, and finally disappear. Nothing awakens in the traveller a livelier remembrance of the immense distance by which he is separated from his country than the aspect of an unknown firmament. The grouping of the stars of the first magnitude, some scattered nebulae, rivalling in splendour the milky way, and tracts of space, remarkable for their extreme blackness, give a particular physiognomy to the southern sky.

"A traveller feels that he is not in Europe when he sees the immense constellation of the Ship, or the phosphorescent clouds of Magellan arise on the horizon. The heaven and the earth, every thing in the equinoctial regions, assume an exotic character.

"We saw distinctly, for the first time, the Cross of the South only in the night of the 4th and 5th July, in the 16th degree of latitude (North): it was strongly inclined, and appeared, from time to time, between the clouds, the centre of which, furrowed by undensified lightnings, reflected a silver light.—If a traveller may be permitted to speak of his personal emotions, I shall add that, in this night, I saw one of the reveries of my earliest youth accomplished.

"When we begin to fix our eyes on geographic maps, and read the narratives of navigators, we feel for certain countries and climates a sort of predilection, for which we know not how to account at a more advanced period of life. These impressions, however, exercise a considerable influence over our determinations; and, from a sort of instinct, we endeavour to connect ourselves with objects, on which the mind has long been fixed, as by a secret charm. At a period when I studied the heavens, not with the intention of devoting myself to astronomy, but only to acquire a knowledge of the stars, I was agitated by a fear unknown to those who love a sedentary life. It seemed painful to me to renounce the hope of beholding those beautiful constellations which border the southern pole. Impatient to rove in the equinoctial regions, I could not raise my eyes toward the starry vault without thinking of the Cross of the South, and without recalling the sublime passage of Danté, which the most celebrated commentators have applied to this constellation;

"Io mi volsi a man destra e posi mente
All' altro polo e vidi quattro stelle
Non viste mai fuor ch' alla prima gente.
Goder parca lo ciel di lor fiammelle;
O settentrional vedovo sito
Poi che privato se' di mirar quelle!"*

"The pleasure we felt on discovering the Southern Cross was warmly shared by such of the crew as had lived in the colonies. In the solitude of the seas, we hail a star as a friend from whom we have long been separated. Among the Portuguese and the Spaniards, peculiar motives seem to increase this feeling; a religious sentiment attaches them to a constellation, the form of which recalls the sign of the faith planted by their ancestors in the deserts of the new world.

"The two great stars, which mark the summit and the foot of the Cross, having nearly the same right-ascension, it follows hence that the constellation is almost perpendicular at the moment when it passes the meridian. This circumstance is known to every nation that lives beyond the tropics, or in the southern hemisphere. It has been observed at what

* We are obliged to a respected friend for the following imitation:—

"I turned me to the right; my spirit flew
To the other pole: four stars shone sweetly bright,
Ne'er seen but by the primal privileged few.
The heavens seemed revelling in their glorious light;
O desolate north! thy melancholy clime
Looked never on their gladdening ray sublime!"

Compare and connect with this the words of the patriarch, "WHO, ALONE, spreadeth out the heavens, and treadeth upon the waves of the sea? Who maketh *Arcturus*, *Orion*, and *Pleiades*, and the chambers of the South?

"Lo, He goeth by me, and I perceive him not: He passeth on, also, but I perceive him not."—JOB ix. 8, 9, 11.

"Seek HIM who maketh the *Seven Stars* and *Orion*, who turneth the shadow of death into the morning, and maketh the day dark with night: who calleth for the waters of the sea, and poureth them out upon the face of the earth. JEHOVAH is his Name."—AMOS v. 8.

hour of the night, in different seasons, the Cross of the South is erect or inclined. It is a time-piece that advances very regularly nearly four minutes a day, and no other group of stars exhibits, to the naked eye, an observation of time so easily made. How often have we heard our guides exclaim, in the savannas of Venezuela, or in the desert extending from Lima to Truxillo, 'Midnight is past, the Cross begins to bend.'—(*Personal Narrative II.* 21, &c.)

ON THE RETURN TOWARD ENGLAND, the equator should be crossed between the meridians of 18 and 25 degrees. When the sun is to the northward of the line, the longitudes of 21 to 23 degrees are to be preferred; because then light and variable winds extend far from the African Coast, especially in July, August, and September, when the sun is returning from the northward.

If the southerly winds become light, a North or N. by W. course may be kept, in order to reach the N.E. trade-wind as soon as possible; but, if variable light breezes are prevalent far to the northward, you should endeavour to pass the Cape Verde Isles at the distance of between 40 and 50 leagues.

In crossing the N.E. trade-wind, a ship's sails should be kept well filled, to enable her to gain speedily to the northward. In this tract the Sargasso or Gulf-Weeds will be met with, which are described hereafter, as existing in the SARGASSO SEA, and which are sometimes found as high as 41° N. See page 181.

Beyond the northern limit of the trade-wind, ships generally cross the parallel of 32° N. in from 39° to 42° W.

Should the wind veer to the N.W. on approaching toward the Azores, you may pass through one of the channels of these islands, and thence pursue a course to the English Channel, according to circumstances.

It is not always advisable to pass to the eastward of these islands, because adverse winds often prevail from the northward between them and the coast of Portugal; and the currents are, also, generally unfavourable to this route: yet it has sometimes happened, that ships passing this way have, with S.W. and West winds, reached the Channel sooner than those which have proceeded to the westward. With these S.W. and westerly winds, you must be cautious in approaching the Channel, in case the current should prevail, which sometimes sets athwart it, as described in a preceding division of this work.—See pages 155 to 165.

REMARKS by M. KRUSENSTERN.—We shall now introduce, by way of illustration, Admiral Krusenstern's description of his route from the parallel of the Cape Verde Islands to the Equator, on his Voyage around the World, in November, 1803, with that of his re-crossing the Line on his return in May, 1806.

"The passage to the westward of the Cape Verde Islands certainly deserves the preference over that to the eastward: as experience has shown to all navigators, that, to the westward, a fresh trade-wind prevails, while to the eastward there are frequent calms. Indeed, very few examples exist of navigators sailing between the Cape Verde Islands and the coast of the continent. I therefore recommend to all those who, on their passage to the equator, take the westward course, to steer in such a direction from the Canary Islands, as to cross the parallel of 17° , (or that of the Island of St. Antonio,) in $26\frac{1}{2}^{\circ}$, or even in the 27^{th} degree of longitude; and then to steer S.E. by S. directly to the equator. They will thus entirely avoid these islands, which are of sufficient magnitude to alter the direction of the trade-wind, and it frequently happens that S.W. winds are met with here. Even if this should not be the case, the wind is always very moderate in their vicinity, and it cannot impede much to steer a degree and a half more to the west than a direct course, when it is with the certainty of keeping a steady wind.

"If, however, it be necessary to have a sight of St. Antonio, in order to correct the ship's reckoning, this may be done at the distance of 30 miles. At all events, especial care must be taken not to come within 20 or 25 miles of it; as there is otherwise the risk of being driven, either by storms or by calms, too near the land.

"When I was going to India, in the year 1797, on board the English line-of-battle ship, *Raisonable*, we experienced the danger of sailing too near this island; and, even in this voyage, were made aware of its vicinity: for, in the night, previous to our seeing St. Antonio, it suddenly became calm; but, so soon as we withdrew from the land, the wind freshened. Although we had lost sight of the island, and were in 27° degrees of longitude, the wind blew very moderately from the south and east. I waited now, with impatience,

for

for the true N.E. trade-wind, that I might return to the eastward, which I proposed to do for about 20°, in order to keep clear of the southerly winds and strong easterly currents, which are found in the region between the N.E. and S.E. trade-winds; and I wished, too, not to cross the line more to the westward than the 24th or 25th degree of longitude.

"Ships have been driven, when crossing the line, to the westward of the 24th or 25th degree, by strong currents and a wind too southerly, so near to the coast of Brasil as not to be able to clear Cape St. Augustin. If the wind, however, will allow the passage of the line in 20° or 21°, a ship should not fail to do so, as she will then have the advantage of a wind directly free, so soon as the S.E. trade sets in; and will, of course, advance quicker to the southward. This, however, is rarely possible.*

"Our naturalists made several experiments to-day, to ascertain the cause of the sparkling of the sea, the result of which seemed to prove that it is not merely occasioned by the motion of the water, but is, in fact, produced by little organized beings. They took a dish, over which they spread a fine cloth, doubled, and poured the water on it, as it was taken out of the sea. It then appeared that several spots remained on the cloth, which glistened as soon as it was shaken, while the water which had passed through it did not seem in the least impregnated with phosphorus, although mixed with saw-dust to replace the want of the matter which was now separated from it, and might have been supposed to have given the sparkle to the water when in motion. Dr. Langsdorff, who examined these fiery bodies with a microscope, and has made drawings of several of them, found them to be, particularly the larger ones, in the form of crabs; and in the small ones he observed fibres, evidently denoting organization.—(See more on this subject in the *Description of the Canary Islands, hereafter.*)

"On the 10th of November, in latitude 13° 51' N. and longitude 27° 7' W., we fell in with the N.E. trade-wind. It was still, however, considerably to the eastward: namely, E. by N. and E.N.E. We held, therefore, as much as we were able, to the S.E.; and this was the more necessary, as we had to work against a strong current, which threw us back nearly 20 miles a-day. On the 15th, at noon, when we were in latitude 6° 58' N. and long. 21° 30' W., the whole sky became overcast. About two we had some rain, and a squall of wind that continued with considerable violence during two hours. Throughout the night it was very thick, with little wind. We now found ourselves on the borders of the trade-wind, which, after this squall, we had entirely lost, and entered into the region where are found unsettled, and, for the most part, directly contrary, winds, calms, or violent squalls, accompanied by heavy showers, and a hot damp air, as oppressive as it is injurious to health. Several days passed in which we did not get sight of the sun, so that the men could dry neither their clothes nor bedding. I had not, however, a single invalid during the whole of that time. Every possible precaution, indeed, was adopted: I had fires lighted three or four times a week in the hold, which were kept in during several hours, and which is, undoubtedly, an excellent method of drying and purifying the air. At Tenerife, I had laid in such a stock of citrons, potatoes, and pumpkins, that our supply was not exhausted even on our arrival at St. Catharine's. Instead of brandy, I gave the men a pint of the best Tenerife wine; and, in the morning and evening, some weak punch, made very sweet, with a good deal of citron juice in it. We availed ourselves of every moment of sun-shine to dry and air the clothes and bedding. The constant rain, during which we had caught water enough for a fortnight, gave our people a good opportunity of washing their clothes; and I had an awning spread, entirely for their use, between the fore and main masts; where they, also, washed each other.

"This disagreeable heavy weather continued during ten days; in which time we had advanced only about two degrees to the southward; for we had to struggle against a very strong current, that drove us back daily about 15 or 18 miles. At the end of the ten days we had again a fresh north wind, which lasted nearly twenty-four hours, when it veered to

* But see the preceding remarks, particularly those of *M. la Perouse*, page 97. Mr. Luccock, in his 'Notes' on Brasil, has said, "After passing the Cape Verde Islands, the mariner who is bound to the southward, (for Brasil,) feels anxious about crossing the Line. With a good chronometer on board, I should run boldly on toward the American coast, being careful only to avoid falling to leeward of Cape St. Roque, and into the heavy current which sets close around it. Without a chronometer, or knowledge enough to use it with advantage, I should allow, from 17 degrees of North latitude, a westerly drift, beginning with five miles for 24 hours, increasing the allowance until the latitude of 5 degrees be attained, when it should be, at least, 20 miles a day. From that parallel to 13 degrees south, the drift will decrease, and then again become variable."

the S.E., and settled in that quarter as the true trade-wind. We were now in latitude 2° N. and longitude 23° W.

"On the 26th of November, we crossed the equator at about 11 a.m. in longitude $24^{\circ} 20'$ W., after a passage of thirty days from Santa Cruz, Tenerife. Under a salute of eleven guns we drank the health of the Emperor, (Alexander I.) in whose glorious reign the Russian flag first waved in the southern hemisphere.

"I now directed my course toward the Island of Trinidad; the wind was, however, so much from the southward, and the current, at the same time, set so strong to the west,* that we had crossed the meridian of Trinidad in 7 degrees of south latitude. The wind soon freshened, and became more easterly, so that we made a rapid advance, and steered as much to the southward as it would permit. The westerly current, indeed, still flowed; but it had much less force than at the equator. In 14° S. we lost the S.E. trade-wind, and had easterly winds, which, by degrees, veered to N. and N.W. During the whole time that the trade-wind lasted, we were accompanied by an infinite number of bonitos, and harpooned some of them almost daily. They made a fresh and palatable dish for our people."

On the RETURN TOWARD EUROPE, 21st of May, 1806,† at three in the afternoon, the Commodore re-crossed the Line, in longitude $22^{\circ} 18' 30''$ W.; and he says,

"The passage on the line in this longitude, or even more to the westward, on the homeward voyage to Europe, is not attended with any loss of time; for, even by running so much to the westward, a few degrees in so long a voyage cannot make any difference, and experience has shown that the winds in this direction are fresher; while more to the eastward there are frequent calms, and as it is of itself a sufficient advantage to remain as short a time as possible in the unwholesome regions about the equator. I have, indeed, the authority of D'Après against me; but, in all probability, he thought more of a direct course than of the health of his crew.

"We found the VARIATION of the COMPASS, on the day of our crossing the line, by several sets of good azimuths, in the morning $12^{\circ} 8' 45''$ and in the evening $12^{\circ} 7' 15''$ W. In the year 1793, Captain Vancouver found it on the line, in the meridian of $21^{\circ} 35' = 9^{\circ} 20'$ W., which proves an addition of two degrees and three-quarters in the space of eleven years.‡ On my return from China, in 1799, the variation here was found to be $11^{\circ} 33'$; and, in 1764, Mr. Nicholson found it on the line in the longitude of $20^{\circ} 40' = 7^{\circ} 56'$, so that the variation of the magnetic needle in these seas is evidently increasing. This seems also to be proved by every known observation; and there is no part of the world where they can be made at sea with more accuracy than in the regions of the S.E. trade-winds, between

* The direction of the currents from the equator to the 8th degree of south latitude, was S.W. by W. and W.S.W., running from 26 to 35 miles a day.

† Two days before, viz. on the 19th, at five in the evening, "we saw, in lat. $2^{\circ} 43'$ S. and long. $20^{\circ} 35'$ W. in the direction of N.N.W., and at the distance of about 12 or 15 miles, a singular phenomenon, but which, owing to the lateness of the day, we were unable to examine sufficiently close to ascertain the nature of it. A cloud of smoke arose to about the height of a ship's mast; disappeared suddenly; then rose again, and vanished entirely. It could not be a water-spout, nor a ship on fire, as some persons on board conceived, for the smoke rose much too high; and Dr. Horner was of opinion that, if the whole was not an ocular deception, occasioned by a peculiar refraction of the rays of light, it had all the appearance of a volcanic eruption, and was possibly the forerunner of some island."

We have not the least doubt of its having been a volcanic eruption; but it appears, from the report of the American exploring expedition, in 1838, that it has not even left a shoal on the spot. See the description of St. Michael's, of the Azores, in the next section of this work.—EDITOR.

On the 12th day of April, 1831, the *Aquila* of Scarbro', Captain John Taylor, was in latitude $0^{\circ} 22' 15''$ S. and $21^{\circ} 6' 30''$ W. Light winds and fine pleasant weather. At 40 minutes p.m., the water being very smooth, and the ship going at the rate of five knots, a loud rumbling noise was heard under her bottom, and a sensation felt exactly like that of a vessel sliding over a rock: the rudder was so much agitated that the man who was steering could scarcely hold the wheel. No difference could be observed in the colour of the water, nor the smallest rippling. The captain concluded, at first, it must have been a rock; but, after arriving in London, there was not, on examination, the least sign of any scrub on the copper; and it was concluded that there must have been, in the spot above mentioned, a volcanic eruption, the shock of which did not exceed 15 seconds.

‡ Experience, however, shows that the different results cannot be considered as an absolute proof.—EDITOR.

the Cape of Good Hope and the Equator, the sea being constantly calm, and the weather mild and beautiful.—(1806.)

“On the 22d of May, in the fifth degree of North latitude, and 23d of longitude, the sea, with a fresh breeze from the southward, was very strongly illuminated during the whole night; more, indeed, than we had seen it in all the course of our voyage. The waves communicated their brightness to the sails, and the whole ocean appeared wrapped in flame. In the year 1792, the same circumstance was observed, precisely in this part, by Capt. Garnault, of the Ganges.

“We did not fall in with the N.E. trade-wind until the 29th of May, when we reached latitude 6° 37' N. Hitherto we had experienced the unpleasant weather that usually prevails in the regions between the Equator and the N.E. and S.E. trade-winds.”

II. OF SHIPS BOUND TO AND FROM THE WEST-INDIES, WITH INSTRUCTIONS FOR NAVIGATING THEREIN.

The courses of these ships are regulated by the winds and currents, which we have described. The consequence is, a circuitous track, requisite to be taken, not only to the West-Indies, but to the southern ports of the United States. For, having passed Cape Finisterre, as before described, the best course is then to the S.S.W., so as to gain the trade-winds quickly. The preceding observations on passing, or touching at, Madeira, &c., may, therefore, in this instance, be useful, as well as in the former.

In a valuable communication which we have received from Captain GEO. CHEVELEY, of Liverpool, this gentleman incidentally remarks that he would recommend to ships, clearing the English Channel, *if bound for the West Indies*, to make the S.W. quadrant *true*, or so as to pass nearly at an equal distance between Madeira and St. Mary's. Capt. C. adds that, by pursuing this track he has invariably held a steadier breeze, and got much quicker into the trades, than when he proceeded farther to the eastward, and so endeavoured to make more southing. He is aware that the latter is the *general practice*; of which he entirely disapproves, so far as concerns a West-India passage.

SHIPS FOR JAMAICA generally pass to the southward of the island Montserrat, and thence proceed for the high rock called Alto-vela, off the southern point of St. Domingo, whence they take a departure for the eastern end of Jamaica.* When homeward-bound, they pass either through the Windward Channel or the Strait of Florida, as the wind, and other circumstances, may prevail or dictate.

Between the months of October and March, northerly winds prevail over the Mexican Sea and the adjacent regions; and, when northerly winds prevail in the Strait of Florida, the Windward Channel must, of course, be preferred: but, at all other times, at least generally at other times, the quickest, and therefore most eligible passage, is through the Channel of Yucatan, and thence with the Florida Stream in your favour, through the Strait of Florida.

Although the Windward Channel appears, by the Chart, to be the shorter and readier passage, yet ships are frequently opposed here both by wind and current; as will appear by the following statement, made by an ingenious officer already quoted: “After the defeat of the French fleet, commanded by Count de Grasse, in April, 1782, and the British had arrived at Port Royal, in Jamaica, a squadron was detached to gain the Windward Passage, run down the Bahama Old Channel, and cruise to the eastward of the Havanna, to prevent a Spanish squadron, in the harbour, from effecting a junction with the French ships that had escaped into Cape François [*Cape Haytien*.] For six weeks did the English squadron beat against fresh sea-breezes and a lee-current; and, during that time, never advanced farther to the eastward than off Morant Harbour, though the ships were much strained by carrying a press of sail to attain the object; but, after struggling so long, were compelled to return, baffled, into port. Now, though the first object might have been to meet the Spanish squadron, on its way to Cape François, [*Haytien*] if it had sailed, yet, so soon as the effect

* The Americans, who have been much in the habit of going to the West-Indies, with timber, &c., remark that when the flying-fish fly in swarms, and are uncommonly small, it is a certain indication of being near the West-India Islands.—*And. Livingston.*

of a lee-current was ascertained, the object of gaining the Windward Passage ought to have been immediately abandoned, when, by bearing away, with a favourable current, for some distance, and before a fresh trade-wind, Cape Antonio might have been passed the second day, the squadron have been off the Dry Tortugas on the third, and, by beating along the Florida shore, with a weather current, when to the eastward of the meridian of Havanna, it could have stretched over to Cuba in the night; and, in all probability, have gained the appointed station in six days, or even, perhaps, as soon as it could have gained Cape Maize, if the easterly wind had been moderate, and no current to contend with.*

When the trade-wind blows strong, and in frequent squalls, during the summer months, between Jamaica and Hayti, and a short turbulent sea is found eastward of the former, then will those bound for Europe or the United States shorten the period of their voyage by bearing away for the west end of Cuba, and passing through the Strait of Florida. For the Strait presents a more eligible navigation in these months than the Windward Channel. The sea-breeze will insure a quick run to the Channel of Yucatan; and the current, perpetually setting eastward between Cuba and Florida, will, in a few days, carry any vessel into the Strait, where it will be nearly impossible to remain much above two days, in the strength of the stream, after being on the parallel of the Bemini Islands, even if there were not a breath of wind.

But, as the North winds prevail in the Strait of Florida in October, and frequently during winter, when variable winds and strong land-breezes are not common on the Coast of Jamaica, shipping will find this the most favourable period for gaining the Windward Channel. In January or February, if the wind offers a favourable opportunity for gaining the eastern end of Cuba, this track should be taken, but, if the sea-breeze be strong, the Strait of Florida should be preferred.†

When the sun has approached the tropic of Cancer, strong westerly winds begin to blow along the western coast of Florida, and prevail during the months of June, July, and August, from the Bay of Apalaché, southward. These westerly winds cause fluctuations in the atmosphere, which prevail more about the western end of Cuba than farther eastward; and near the Havanna they have little influence. At this season vessels from Jamaica have met a westerly wind in the Channel of Yucatan; others have experienced

* "I think that this paragraph, unless qualified, is calculated to mislead; particularly in the words, 'when, by bearing away with a favourable current for some distance, and before a fresh trade-wind, Cape Antonio might have been passed on the second day.' Admitting the general experience of the writer of this passage, I think he states an extreme case. The distance from Port Royal to Cape Antonio is 518 miles; which (divided by 48) equals more than 10½ miles per hour. Generally, there would be nothing extraordinary in this performance, but I much doubt if it be often accomplished in the locality alluded to at the time of the year supposed; viz. in the middle of May. Rodney arrived at Port Royal on the 29th of April; it is probable that the squadron was refitted on the 5th of May; allow ten days more for its commander to convince himself of the impossibility of effecting the Windward Passage, and he would have bore up on the 15th, from the inferences I have collected on this head: it appears that the run to Cape Antonio is seldom made in May within a week. In that month of this year [1833] I was ordered from Montego Bay to New Providence: at the former place I consulted some of the most experienced commanders of West-Indiamen, whether the most eligible course would be that of Cape Maize or of Cape Antonio: the majority recommended the latter, and I more readily deferred to their advice from its concurrence with that contained in the extract, the previous consideration of which had occupied my mind.

"May 18th at 6 p. m. I sailed; the ship, being light, was in most favourable trim: calms, light winds, and moderate breezes, describe the intervening weather, and we did not pass the Cape until the 23rd, at 2 p. m., or in four days and twenty hours after leaving port. This solitary instance, however, would not afford a sufficient basis whereon to fix a rule: in its support, therefore, I cite the *Memoir*, pages 199, 209, [present edition,] wherein it appears that the *Carshalton Park*, in May, 1824 and 6, respectively, was seven days in performing the same distance, although skilfully conducted. Granting the general superiority in the sailing of ships of war over merchantmen, it is not clear to me that a crack West-Indiaman, of the present day, coppered and even laden, might not be nearly a match for the comparatively ill conditioned, and perhaps wood-sheathed, squadron of 1782.

"Finally, although the advice, contained in the extract above, is judicious in establishing the advantages of the Leeward Passage, I repeat that the hopes of making it so speedily as is represented will not often be realized, for the pages last quoted also show that neither very favourable currents nor fresh trade-winds will be experienced upon that track at the season indicated: nevertheless there is the all-important distinction between the passages of *certainly and uncertainty*."

Lieut. W. H. Brady, R. N., late Agent of the *Numa*, transport, 1833.

† In sailing for the Windward Channel, get the coast of Hayti on board as soon as you can, as you may then find a windward current, and, in the evening, the wind off shore.

a fair

a fair breeze at some distance, after passing Cape Antonio; and the wind here will be found sometimes at N.W., West, and S.W., veering about variably.

The wind in the eastern quarter, sometimes fluctuates about the western end of Cuba, but not generally.

At this season the wind blows impetuously off Jamaica, and in frequent squalls; and vessels bound thence to Europe, should universally prefer the leeward passage. They will probably pass through the Strait of Florida before they could gain the entrance of the Windward Channel, though straining, with every effort, against the wind.* The appearance of a favourable opportunity for passing through that channel should not be suffered to deceive; for it may be no indication of the general state of the wind eastward.

VESSELS BOUND FROM THE WEST-INDIES to the ENGLISH CHANNEL, after having cleared the Strait of Florida or Windward Passages, may pass either to the northward or southward of the Bermudas, giving the islands a good offing, and attending to the preceding remarks on currents, &c. (See page 217.) In summer, the track to the northward of these isles has been recommended, passing thence to the northward of the Azores. In winter, the track to the southward of the Bermudas is to be preferred; because in this season, gales of north-westerly wind may be expected from the Coasts of America: and, therefore, vessels should continue a little to the southward of latitude 30° , or in about $29^{\circ} 40'$, if wind permits, until certain of being to the eastward of the Bermudas; nor should they run to the northward of 35° or 36° , until within a few degrees of the Azores. Thus will the heavy gales be avoided, which frequently rage more to the northward.†

But, upon this subject, Major Rennell has said, "Notwithstanding the advantages to be gained, in point of distance, by ships returning from the West-Indies, by the favouring current of the *Gulf-Stream*, which may be perhaps reckoned equal to several days' ordinary sailing; yet experienced navigators are still of opinion that, on the whole, it does not present equal advantages with the southern route.

"It was, until latter times, held as a maxim not to advance to the northward of the parallel of 33° , in returning from the West-Indies, because of the prevalence of storms to the northward of it. This wise rule of our ancestors has been again taken up, and his Majesty's ships, and of course convoys, will be, in future, directed to proceed by the South of Bermudas, and to cross its parallel at a few degrees to the eastward of the isles, and thence to steer direct for Corvo.

"But, it may be observed that, a track which should cross the parallel of Bermudas at a *very few* degrees to the eastward of it, and then lead directly toward Corvo, would cross a most critical portion of the space in which, not only the warm water of the *Gulf-stream* prevailed, but in which several gales have been actually experienced. Therefore it would seem that the parallel of the Bermudas should not be crossed at less than about fifteen degrees [say 14°] to the eastward of the islands.

"But, it may be asked, Where is the necessity of going to Corvo or Flores at all, for by it ships are placed in a situation proverbially known as a place of storms; that is to say, on the West and N.W. of the Azores: why not go between *them* and the *greater Azores*; or, rather, to the southward of them all, and thereby pass through a kindlier climate at all times?

"Any calculation or comparisons of time in making the different passages would be nugatory; since the security of lives and property is the main object; but it even happens that ships, which have had all the advantage of the *Gulf-stream*, have been crippled, and made more delay than in the southern passage with adverse currents."

On the 17th of July, 1828, H.M. Sp. *Bustard*, sailed from New Providence for England; winds from the southward and rainy weather. Found a current setting to the eastward, at an average of nearly three-quarters of a mile per hour, to longitude 60° . Having passed to the southward of Bermudas, off the Western Islands had thick hazy weather, with small rain. Winds very variable. On the 11th of August ran into Fayal Roads from the northward, and anchored in 20 fathoms, with the west end of St. George's

* See Observations on Winds, page 104.

† As the most destructive hurricanes on record, in this part of the Atlantic, have occurred in the vicinity, or on the borders, of the *Gulf-Stream*; this is an important reason, for ships from the West-Indies, bound to Europe, not to advance too far to the northward. See, farther, '*Voyage from the West-Indies to the Azores*,' attached to the description of those islands hereafter.

Island, E. by N. $\frac{1}{2}$ N., Castle of Sta. Cruz, situated near the south part of the town of Orta, W.N.W., off shore about a mile. Supplies may be obtained here at a cheap rate, but the water is rather brackish. Found the longitude of the anchorage, by chronometer, $28^{\circ} 41' 30''$. The current runs strongly here, and between Pico and Fayal it seemed to set at the rate of nearly 3 miles in an hour.

DIRECTIONS for SAILING to and from the WEST-INDIES and NORTH-AMERICA : translated from the 'Derrotero de las Antillas,' by Captain Livingston.

These advices, or directions, are simple applications of a principle derived from the general prevalence of the winds, as already described.

Were it not for the constant wind from the eastward, which reigns within the tropics, it seems likely that the maritime commerce, between the two hemispheres, would never have existed ; for, by its means, not only are the voyages rendered very simple, which would otherwise be interminable, but people in the most distant regions communicate with facility : and thus the navigator, who is bound to the westward, has only to place himself within the limits of the general wind, in the certainty that, in this manner, he must effect his purpose in the shortest possible period. Such is the *first rule*, which ought always to be attended to for this navigation.

The *second rule* is derived from the first ; it is, that any one, bound to the east from the west, ought to get out of the region of the general winds into that of the variables.

We have here the two precepts which direct the operation of navigators in extensive seas ; and, in attending to them, we shall observe that, every one bound from the Peninsula (Spain and Portugal) to the eastern coasts of America, ought to get into the trade-winds as soon as may be, holding in mind an advice, which may be considered as a precept, that is, *never, in navigating extensive seas, to keep close hauled, but always take care to sail with the wind free ; or, at least, to keep seven points from it.*

Taking it as granted that the first care of every one bound to America ought to be to get into the limits of the General Wind, it is clear that, with scant winds, the tack in the third quadrant (S.W.) will be most advantageous, and ought to be followed always when it can. All the endeavour ought to be to get into these winds without being particular as to the means, and without keeping close to the wind to pass between the coast of Africa and the Canaries ; but taking the passage that suits best, be that between the Canaries and Madeira, or be it between Madeira and the Azores : and certainly either of these is preferable to that to the east of the Canaries ; for the proximity of the coast of Africa deadens the wind, and, consequently, is unfavourable to the brevity of the navigation.

Having gained the General Winds, the navigator must take precautions conducing to prevent any error of situation, in making his port of destination ; for, if he who navigates by observations is exposed to be even ten leagues in error, he who has no more than dead-reckoning to direct him may, probably, be six degrees wrong. It imports much to guard against this error ; keeping it in view that, in proportion as it will be easy for any one, making a landfall to windward of his port of destination, to run down to it ; so will be the difficulty, if he makes this landfall to leeward of his port, in beating up again in a sea wherein both the winds and currents are contrary. Even if bound to the coasts of the United States of America, it will be advisable to run into the limits of the trade-winds, in order to get to the westward in as short a time as possible ; and, although this mode may appear long, on account of having again, after crossing, to augment the latitude, it will be sufficient to keep in view the following maxim, to convince any one of the contrary :—*If in the one way the distance is shorter, in the other the velocity with which the ship proceeds, toward her port of destination, more than balances it*

There are, nevertheless, many occasions on which a vessel may run across to the American coast without reducing her latitude, and these occasions may be frequent in the forty or fifty days which follow the two equinoxes, as epochs during which the N.E. winds generally prevail ; therefore vessels which, at these times, make their passages, may at once follow their voyage in high parallels, without descending to low ones.

In summer, as the region of the General or Trade-winds extends to about latitude $28^{\circ} 30' N.$, it follows that the round about is trifling ; and this circumstance ought to be attended to in the calculations which every captain of a ship ought to make before he fixes on the course he will pursue.

Recapitulating what we have said about the course which is most advisable for crossing to the United States, from the coasts of the Peninsula, it follows that, if the winds permit it, West is the preferable course; and, in case the winds will not allow of shaping that course, the most advisable tack will be that which comes nearest to it, if the voyage is made at the times above mentioned after the equinoxes; but if at any other time, a course in the third quadrant [S.W.] should be preferred; for this will carry the vessel soonest into the General Winds, with which the necessary longitude may be shortly gained.

VESSELS BOUND TO CUBA, during the rainy season, or season of the South winds, should pass to the northward of Porto-Rico and Hayti: but, during the Norths, they ought to go to the southward of these islands. The ports chiefly frequented are, St. Iago on the South, and Havanna on the N.W. If bound to the first, it is necessary, in whatever season, to proceed directly to it: that is, in the season of the Norths, to steer from Cape Tiburon, to make some point on the South of Cuba to windward of the intended port, or even to windward of Guantanamo; and, in the season of the Souths, to steer from the Point of Mole St. Nicolas, almost West for the port, marking, in the first instance, various points on the coast of Cuba.

If bound to Havanna, in the time of the Norths, you should pass to the southward of Cuba, although you will have to return the distance between Cape Antonio and Havanna; because this inconvenience is not comparable to that which might be occasioned on the North side of the island by a hard North, which would not only expose a vessel to heavy risks, but might protract the voyage much longer than the course above described, because the distance in the latter case may be worked up in a short time.

From St. Iago de Cuba, as the coast is clear, a vessel for Europe may easily make her way by the Windward Passages, while all those which are bound from Havanna will take the Strait of Florida. The risks in the latter emanated from bad charts and ignorance of the currents: the charts are now rectified, and the current is known.

By the STRAIT OF FLORIDA, we understand the space included between the meridian of the Dry Tortugas and the parallel of Cape Canaveral. The simple inspection of the Chart will show this to be a bed or course, which, like a river, conducts the water to the northward. This river, or general current, flows first to the E.N.E. as far as the western meridian of the Double-shot Kays, by which Kays the stream is diverted from E.N.E. to N. by E., the direction which it pursues on the parallel of Cape Florida: thence to Cape Canaveral it runs North, with something of an inclination to the East.

As it is undoubted that this General Current is caused by a superabundance of waters, which seek, by this drain, to regain their level in the open ocean, it follows that, its rapidity will be greater or less, according to the said superabundance of waters; but, as a change cannot be momentary, on account of the great reservoir in which the water is contained, but progressive, and, of course, slow: we hold that, having once ascertained the velocity of the current, we may calculate it for three days, or more, in advance, without much error, if the wind remains in the same direction; for an alteration in the wind may affect the force of the current considerably, as already explained.

On the meridian of the Havanna stripes of current are, at times, found setting to the E.S.E. and S.E. from the Tortugas Soundings. Care should be taken not to confuse the southern differences, caused by this branch of the current, with those caused by the eddy current near the Colorados; the one giving eastern departure, the other west. The distinction is very clear, and can admit of no doubt, because the eddy current is met only from the meridians of Cavanis and Bahia Honda to Cape Antonio, and not farther out from the coast than the parallel of 23 degrees.

As the velocity of the current varies, it is requisite for every navigator to ascertain its strength as frequently as possible, while within the Stream. Every one who enters this channel, having marked well either the lands of Cuba or the Florida-Reef, so as accurately to establish this point of departure, ought to determine, in his *first day's* work, the velocity of the current by the difference of latitude by account and observation. We say during the first day's work, because the generality of common navigators make use of meridian altitudes of the sun alone to find the latitude; but it is very clear that *altitudes of the planets and fixed stars ought not to be neglected; not only because by this you cannot be in doubt of your real latitude, but also, because they may be more exact than latitudes deduced from meridional altitudes of the sun, when that luminary passes in the proximity of the zenith, and because these repeated observations, during the night, assure, as much as possible, the situation of the ship.* Thus you may go on, with a clear idea of the operation of the current,

current, and the way that the ship is making. Having ascertained the velocity of the current, use can be made of it to find the ship's departure, and this knowledge will be most important when you fail in obtaining observations for latitude; because, in such a case, wanting a knowledge of the difference of latitude given by the current, you will be in want of every thing; but, if you know the velocity of the current, with it and the course which it follows, you may find the difference of latitude and departure which the current gives; and which, though it will not give the position of the ship with that precision with which it might be obtained by latitude observed, will still approximate sufficiently to the truth to enable one to avoid danger, if prudence and seaman-like conduct are combined.

For those who have little experience in the art of navigation, we add :

1.—That it is most convenient to direct your course in mid-channel, not only because it is the farthest from danger, but because you will there have the strongest current, which is desirable.

2.—That, as you cannot ascertain, with all necessary certainty, the position of the ship, notwithstanding the rules given to diminish the errors occasioned by the currents, you ought, with the utmost care, to shun the eastern coast of Florida, as being very dangerous, the trade-wind blowing upon it; while there is not the least risk in running along the Salt-Kay Bank, and the edge of the Great Bank of Bahama. Upon the latter, also, you meet with good anchorages, very fit to lie in during the hard northerly gales experienced between November and March, and which do not fail to cause many damages, and sometimes even force vessels to bear away, which is always dangerous, for the weather is always thick with such winds, and the worst case will be to run in one of them upon the coast of Cuba, when hoping to have made Havanna or Matanzas. Hence, therefore, so soon as there is an appearance of a North, the best way is, if near the Salt-Kay Bank, to anchor on it; and, if near the Great Bank, to approach the edge of it, in order to be able to anchor when it may be necessary; for, although you may have a hard *North*, so long as you can lie-to in it, you ought to pursue your navigation, as the current will certainly carry the ship through the Strait.

3.—It is very necessary to sight the Kays on the Salt-Kay Bank, even though you have no fear of a *North*; and there may be occasions in which every exertion should be made to make them; especially if, from want of observations, the situation of the ship is not well known.

4.—When, owing to calms or light winds, a vessel is in danger of being carried through the Strait by the current, she ought immediately to approach the edge of the Salt-Kay Bank, or of the Great Bank, to descend from it to the coast of Cuba, without trying to beat down the lost ground; for, by doing this, she would only render the being carried through more certain.

5.—Should you involuntarily approach the Coast of Florida, you should take extraordinary care to examine whether you have advanced out of the General Current and into the Eddy. That you may know this, observe, the Eddy forms a remarkable and visible line between it and the General Current, which line of division is, in many places, out of sight of land; that, in general, you have no soundings on it; and that it shows, not only by the change in the colour of the water, but that also in it, during the greatest calms, there is a kind of boiling or overfalling of the water. From this line of division the water gradually changes colour; so that near the Florida-Kays it is of a beautiful sea-green, and, at last, it becomes almost as white as milk.

6.—When in the Eddy, you have to make the correction of currents on courses entirely different from those in the Stream. This is the more necessary to be remarked, because, from ignorance of this circumstance, several have been shipwrecked.

7.—When you enter the Channel, or Strait, from the Tortugas Soundings, with the intention of passing through, take care to become certain of the land of Cuba, or some part of the Reef of Florida, in order to have a good point of departure: for, although the latitudes and soundings on the Tortugas Bank are more than sufficient to ascertain the place of the ship, yet the variable set of the current toward the Havanna may produce a serious error, if not properly attended to. The meridian of the Havanna is, in a word, the best point of departure for ships bound to the north-eastward.

ON PROCEEDING TO THE WINDWARD OR CARIBBEE ISLANDS.

As to choosing the north or south part of any of these isles for making your land-fall, you ought to consider, *firstly*, which point is nearest to the port or road to which you are destined; and, *secondly*, the season in which you go. In the dry season, it is to be remembered that, the winds are generally from the north-eastward, and in the rainy season they are often from the south-eastward. Thus, in the dry season, it is best to make the north side, and, in the wet season, the south, but without losing sight of the first consideration.

There can be no mistake in recognizing any of the Antillas; nor, in making St. BARTHOLOMEW's and St. MARTIN's alone, can there be any doubt on seeing at once the eminences or heights of various islands. That this may not mislead any one, they must remember the following instructions:

When in the parallel of St. Bartholomew's, at less than 4 leagues off, if there be no fog or haze, the islands of St. Eustatius, Saba, St. Christopher's, Nevis, and St. Martin's, appear plainly.

The mountain of St. EUSTATIUS forms a kind of table, with uniform declivities to the east and west: the top is level; and at the east part of this plain a peak rises, which makes it very remarkable. To the west of the mountain seems to be a great strait, in consequence of the lands near it being under the horizon, (or seeming drowned,) and to the west of that there then appears, as it were, another long low island, the N.W. part of which is highest; but it is necessary not to be deceived, for all that land is part of the land of St. Eustatius. From this station Saba appears to the N.W.; it is not so high as St. Eustatius, and apparently of less extent than the western part of St. Eustatius, which is seen insulated.

The N.W. part of St. CHRISTOPHER's is also seen formed by great mountains, in appearance as elevated as St. Eustatius, with low land to the east; to the eastward of this low land NEVIS will be seen apparently higher than all the others.

The lands of St. MARTIN's are notably higher than those of St. Bartholomew's; and this island appears also when you are some leagues farther distant from it than from St. Bartholomew's.

When there are any clouds which hinder St. Martin's from being seen, there may be some hesitation in recognizing St. BARTHOLOMEW's; and thus it is proper to notice that the latter, seen upon its own parallel, appears small, and with four peaks, trending north and south, and occupying almost its whole extent; and, if you are not more than 8 leagues from it, you will see, also, the appearance of an islet to the north, and another to the south, at a very short distance. As this island has neither trees, high mountains, nor thickets, it is not subject to fogs; and it may therefore be seen oftener than St. Martin's, St. Christopher's, Nevis, St. Eustatius, and Saba; it is therefore advisable to keep its appearance in mind.

At eight leagues to the east of St. Bartholomew's you may see NEVIS, very high; from it to the west the strait called the Narrows, and then the lands of St. CHRISTOPHER's, appearing to rise out of the water, and which continue increasing in height to the westward, so that the westernmost of two mountains, which are at the west part of it, is the highest. This mountain, which is higher than that called *Mount Misery*, has, to the west of it, a gentle declivity, terminating in low land; and it cannot be mistaken for any other. To the west of this you may also see the large strait toward St. EUSTATIUS; but from this situation you will see only the high S.E. part of that island; or, rather, its mountain, in consequence of which it appears like a very small island, while its mountain seems to be lower than Mount Misery; but it is easily known by the *table*, which its top forms, by the uniform declivities to the east and west, and by the peak on the S.E. part of it. SABA seems, from this situation, equal in size to the visible part of St. Eustatius; but it shows only an eminence without peaks, with uniform declivities, and almost round.

If a small islet appears to the west of, and very near to, St. Eustatius, that must not confuse you; for it is the N.W. extremity of that island: and, on getting nearer, you will perceive the land which connects it with the S.E. part. *Mount Misery*, on St. Christopher's, which has a very high and sharp peak, on the eastern part of its summit, seems at a distance to be the summit of Mount Eustatius; but it cannot be mistaken for such, if you attend to its surface being more unequal than the table-land at the top of St. Eustatius; and that

that there is another less elevated mountain to the east, and with gentle declivities, which show much land to the east and west of the high peak.

When you are six leagues to the east of St. Bartholomew's, its N.W. extremity appears insulated, and has the appearance of a pretty large island, on the top of which there are four small steps, (like steps of stairs, *Escalones*,) with a considerable strait to the south, between it and the principal island: in the middle of this strait you may also see a smaller islet: this is really one of the islets which surround the island; but the first is only the N.W. point, to the north of which you will also see some islets: all these are much nearer St. Bartholomew's than St. Martin's.

FINALLY, in navigating from one of the Antillas to another, there is no difficulty, unless you have to get from leeward to windward; yet this will be reduced to a trifling consideration if the passage be made by the straits to the northward of Martinique, and in which the currents are weakest; but the same does not follow in the southerly straits, in which the waters set with more vivacity toward the west: and it would be impracticable by the straits of Tobago, Granada, and St. Vincent, in which the waters commonly run at the rate of not less than two miles an hour.

PARTICULAR INSTRUCTIONS FOR THE NAVIGATION OF THE WINDWARD ISLANDS, &c.

It has been lately remarked, by an experienced Captain in the Royal Navy, that for *those bound to Jamaica, or to any of the ports in the northern range of islands* (the Bahamas excepted,) the safest land to make is the island of Desirade, near Guadaloupe; for, if you should not see other land before dark, you may haul to the northward, into the latitude of Montserrat, having nearly sixty miles to run on, during the night. Some commanders make St. Martin's or St. Bartholomew's, when bound to Tortola, St. Thomas', St. Croix, and the islands to leeward; but in this case they should be aware of the dangerous island of Barbuda, and also of Anguilla; for a small error in the latitude, perhaps from want of an observation, or irregularity in the current, would place them in a very perilous situation, should they attempt to run on in the night.

Strangers should pass St. Martin's, when they make it, on the north side, the passage between it and Anguilla being clear; St. Bartholomew's, Nevis, St. Christopher's, and Antigua, on the south side. Barbadoes should likewise be passed on the south side, in order to fetch into Carlisle Bay; and Granada and St. Vincent's on the south side. No particular directions are necessary for the other islands, as every seaman knows the danger of running to leeward or past the land;—a very serious occurrence for a dull sailing vessel.

Vessels, on making Barbadoes and the other Windward Islands, when approaching from the northward, should be very careful not to cross the latitude of the low or northern islands during the night, although their reckoning may be many degrees to the eastward of the isles. The low islands on which so many vessels have been lost, are *Barbuda, Anguilla, Dog and Prickly Pear, Sombrero, Anegada*, and its *Horse-shoe Reef*; of all these, the first and last are the most dangerous. Before you see Anegada, in clear weather, Virgin-Gorda, and perhaps Tortola, will be seen very distinctly; distance is often deceiving at sea, and this land by those not well acquainted with it, has been frequently mistaken for the East end of Porto-Rico; and, although directions have been given for avoiding this error, by observing that there is only open sea to the eastward of Virgin-Gorda, and that to the eastward of Porto-Rico lie several islands, yet it is necessary to observe that these islands, when the high land of Porto-Rico is first discovered, cannot be seen; so that, if you make the land at the close of day, it is proper to be aware of this circumstance. It may be also remarked, that Anguilla and the Dog and Prickly Pear Isles cannot be seen until some time after you make St. Martin's, which is high land, and lying to the southward of these low isles. Barbuda is not dangerous in the night time only, but to strangers also in the day, having reefs under water all round, excepting at the extreme S.W. point.

On passing to leeward of the high islands which obstruct the course of the trade-wind, danger arises from strong gusts coming from the mountains, which sometimes dismast a vessel. Be cautious to keep so far from such land as to be able to work your ship, should the wind suddenly shift and blow on the shore, which it often does during the day. When the wind is baffling, you will find it advantageous to keep your course along shore so long

as you have steerage-way, although all your sails may be aback; for it frequently happens that the wind comes round to its former quarter before you lose your headway, and by this one ship may get into another current of air, which brought her into a fresh breeze, while another, in company, by altering her course to get her sails full, loses the opportunity of getting into the breeze, and may be detained by calms and baffling winds great part of the day. We have often seen the after-sails filled, with the wind aft, while the head-sails were flat a-back, with the wind a-head, and which continued so long that the foresail was hauled up to continue the headway.

In navigating among the Windward Islands, every precaution must be taken in allowing for the direction and strength of the currents. It has already been shown, in the preceding section, that the general prevalence of them is to the westward, but with different velocities, disturbed at times by the lunar influence, and varied by the contour of the coast, &c. An easterly current is seldom or never found out of sight of land, but N.W. and northerly, in the passages, may generally be found; and it has been remarked that, in some instances, when the current runs to leeward on one side it runs to windward on the other; also that it may set to windward on both sides, while, at the same time, to leeward in the middle, and frequently the reverse.

The intelligent officer to whose book we are indebted for these observations, says, "In the day time, attention to the progress you make in getting to windward, by the appearance or bearings of the land, is the best rule you can have, first trying a short tack in-shore, where, if you make little or no progress to windward, your best way is to stand across, and try the other side of the channel; and, if that do not answer, the mid-channel will most likely prove the best; for, although contrary to the general opinion, we have often found it so; much, however, depends on the time of day. In the morning and evening you should endeavour to be near the shore, the north side of the passage in preference, where, if the wind be moderate, and the coast not much exposed to the general trade-wind, you are pretty certain of having the wind two or three points more off the land. In like manner, you should endeavour to be in the offing about one o'clock, *p. m.*, as the wind generally blows more on the shore at that time. We have also observed that the land and sea breezes prevail most where the land on the coast is low.

"Should you be bound to a place to the eastward of you, and no land in the way, the best tack to be upon is the one on which you will lie up nearest to E. by N., that being the point from which the trade-wind generally blows; when it changes from that point you may consider it a slant of wind, and take advantage of it accordingly,—particularly if it veer to the South during the day, or to the North by night; thus it will be found to be advantageous to be on the larboard tack at night, and the starboard tack by day."

In squally weather the wind is so very variable, that it is seldom possible to take advantage of it in getting to windward.

To windward of the islands and to the north of Barbadoes, in moderate trade-winds, the Equatorial current will be found generally to set in a direction from N.W. by N. to N. by W. at the rate of from half a mile to three-quarters of a mile an hour. As you approach the islands, it becomes more irregular; near to the eastward of *Point Salines*, Martinique, it frequently sets strong to the North, and even N.E. We have also felt this set of the current near to Point Moulacique, the south point of St. Lucia, and have frequently seen vessels bound to Gros Islet Bay, St. Lucia, from Barbadoes only the night before, driven so far to the north as to have passed the island of St. Lucia, and also a considerable part of Martinique, before they discovered their mistake; and, being strangers, they had to wait until an observation could be taken to ascertain the latitude, before they could find out their true situation.

In the passages lying nearly in a north and south direction the current sets generally about N.N.W., until you are past the most northerly land on the eastern side of the passage, when the western current, being no longer obstructed by the land, sets with great strength in a more westerly direction. This is the case in all the passages from Antigua to Hayti, and those on the south between Trinidad and Paria, and on the coast and Leeward Islands from Margarita to Buen-ayre, as the current inside to the south of these islands [in the dry season] sets about N.N.W. $\frac{1}{2}$ W. at the rate of nearly two miles an hour. Ships running to westward, inside, should make an allowance for it, and keep a good look out; for it must be borne in mind, as already shown, that the currents here are variable, according to the season.

In order to touch at as many of the Windward Islands as possible, without having to beat to windward;—suppose your vessel to be at Barbadoes, and you have to call at as many islands as you can, in as little time as possible—from Barbadoes you can steer for Tobago, hence for St. Vincent's, which is as far to windward as you can fetch; and, with a northerly trade-wind you will not be able to do that. From St. Vincent's you may steer to any of the Granadines, and so on to Granada; and, at times, you may fetch Trinidad, but this is not to be depended on. From Granada you cannot always fetch St. Kitt's, but in general, the Virgin Islands, St. Croix, St. Thomas', &c. The general course this way is to go to Tobago, and thence to Trinidad.

Another track is from Barbadoes (S.W. side) to St. Vincent, (South side) hence to the Granadines and Granada.

From Barbadoes to the N.W. you may go to St. Lucia, passing round the N.E. point of the island to Gros Islet Bay and the Careenage; from this place you fetch Fort Royal Bay, Martinique, then St. Pierre, Roseau, (Dominica,) the Saintes, Basse-terre, and sometimes Point a Pitre, Guadeloupe.

From Basse-terre, Guadeloupe, you can seldom weather Montserrat, unless you tack and take advantage of the variable winds under Guadeloupe, which is the best way, if you are bound to Antigua, or to the northward between Antigua and Nevis; but if not, you may pass close to the west side of Montserrat, and so steer for Nevis or St. Kitt's, or to the islands to the westward; or, you may pass on either side of St. Eustatius or Saba, if you can lie round without tacking, and so through the Dog and Prickly Pear or Sombrero passage to the northward.

In steering through these passages, or across them, it is recommended to keep well to windward, as the wind will often head you as you approach the opposite side, and the currents are very strong; and, it may be remarked that, in standing to the southward, you feel the force of the current more than when you are standing to the northward.

From these remarks, and a reference to the chart of the islands, it may be readily seen what other track can be accomplished. Thus, from Barbadoes to Antigua, and the islands to the westward of it, you pass to the eastward of Desirade if you can; if not, between that island and the east point of Guadeloupe; when you are clear of this last point, you have Antigua and all the islands to the westward in your route.

The intercourse between Barbadoes and Demerary is very uncertain, and you cannot always trust to fetch from one place to the other, even in fast sailing vessels. From Demerary you can generally weather Tobago; of course it must always depend on the wind and current; therefore we speak in general terms only. Indeed, we have sometimes seen southerly trade-winds continue for a long time, and also northerly winds; and we have seen, owing to N.E. winds and lee-currents, vessels from Cayenne not able to weather Barbadoes, and a vessel from Antigua a month in getting to Barbadoes, owing to southerly winds.

In working to windward through any of the passages in the night-time, it is strongly recommended not to trust to the distance run; for, although you may have an offing of four leagues, and you could lie up so as to make a long stretch, yet, before you have gone the distance of your offing, you will probably find it full time to tack from the shore. *In the passages lying nearly East and West*, the western current runs so swiftly, that, in standing to the southward on the larboard tack, and lying up S.E. by E. you will often find that you have made little or no easting. This has been the case with several vessels leaving the south shore of Antigua; they stood on, lying up S.E. by E., which course they expected to make good, and thought perhaps to weather Point Antigua on Guadeloupe, but the current deceived them, little or no easting had been made, and they ran ashore among the small kays off the Bay Mahaut, Guadeloupe, nearly due South from that part of Antigua which they had left in the previous evening.

When bound to windward it is sometimes difficult to beat through the passages between the islands. Of these passages, the easiest are considered to be between St. Vincent's and Becquia, between Martinique and St. Lucia, and between Antigua and Guadeloupe. The wind, in general, blows a strong breeze, so that a vessel may carry double-reefed topsails, courses, top-gallant sails, jib, and driver. These are the most suitable sails for working the ship in the night, the weather in the passages being too generally squally. If more reefs are out, you will be liable to spring your masts and yards; for however fine the weather may appear, strong and sudden gusts may come on several times in an hour. Finally, too much

much sail is hazardous, as the squalls may head you until they blow past, when you come up to your old point; and in this way it is obvious you may run a long way to leeward in carrying sail through a squall.

Throughout the West-Indian Sea, among the islands, the bottom will be generally found to consist of coral rocks, and the great advantage of having chain cables, both in point of safety and economy, must be obvious to all.—“*The Seaman's Practical Guide*,” &c. 1832.

GENERAL REMARKS ON THE NAVIGATION OF THE CARIBBEAN SEA, from LEEWARD TO WINDWARD; by LIEUT. GREEVELINK.

The best way to beat up in the Caribbean Sea is still an object of dispute among a great many European mariners; there are some, and they form the greatest number, who always prefer the northern part; others who choose to keep in the middle between 14° and 16° of latitude; and a few, to beat up off the southern coast, till they are able to make Antigua, and run out by the channel between that island and Guadaloupe.

The first of these methods, the one generally adopted, is evidently the best: as the south coasts of Hayti and Porto-Rico are tolerably clean, and afford smooth water when the wind is to the northward of east; but in the hurricane months, this part is rendered unfavourable, not only by these dangerous visitors, but also because the currents are then often very strong in the northern channels, whereas they have, at the same time, been observed to be very weak in those southward.

The second route depends, I imagine, more on vague reports of a current setting between those parallels to the eastward; but this will, I trust, no longer be credited, at least, in the tract of sea here described. During the intervals, however, in which light winds are of some duration, the westerly current may be found very weak, as is undoubtedly proved by our passage in April, 1837. (See the entry of that month, Col. Nav. vol. iii. p. 26.) Yet this is no reason why a constant weak current, or an easterly one, should be stated when found only occasionally in those parts where they have once been met with.

The third route, by which the hurricanes are generally avoided, has been treated with too much neglect, partly by its being impeded by the Leeward Islands, and partly by the unknown force and direction of currents, and want of local experience of the coast; but hereafter I doubt not but this track will be adopted as the best in those months which threaten destruction in the northern passages, because it is almost universally followed by the coasters and pilots.

Commanders bound from one of the interior parts of the Caribbean Sea, toward the coast of Guyana, generally prefer passing out by the channel of Antigua and Guadaloupe, which is one of the fittest for that purpose with northerly winds; but when, on the contrary, the wind is from the southward of east, I should not advise any attempt to pass that way, but to proceed directly to the north, by the westward of Barbuda, prolonging the stretch well, in order to gain at once, with the other tack, the windward side of the islands. In July, 1836, we laboured for several days to get out of the first-mentioned passage; and in August, 1835, we were happy enough to reach English harbour, though unable to effect our purpose of getting into the main sea, being harassed by south-easterly winds and strong westerly currents; and during our stay were visited by the hurricane which has been described. (See page 131.)

After having reached the Atlantic, when destined toward the coast of Guyana, it is best to keep your wind, if blowing from the northward of east; as, in that case, it may enable you in one stretch to make the desired port; but, with unfavourable winds, I think it advisable to run straight for the coast, and beat to windward therealong in the space of soundings. This is most probably attended with less loss of time than the working to the eastward in higher latitude, which may be proved beyond any doubt by comparing some of the many instances which have occurred of vessels falling to leeward of their port of destination, and which tried to regain it by making a long stretch to the northward: when, after fourteen days, they made the coast nearly at the same place; with those of others who effected it completely, in only three or four days, in the space mentioned. I know many reports of this sort, but they want sufficient authenticity to be relied on.

As a general remark it may be kept in mind that, to get soundings ought to be the principal object of ships bound to this coast, as, with the present knowledge of depths here-
about,

about, together with an observed latitude, it may show them their place of situation east or west of the intended place very near the truth, because the general tendency of the mud-bank is nearly N.W. and S.E.; and thus, to the eastward of a certain meridian, there will be found more water than to the westward, upon the same parallel.

It is absolutely erroneous to state, that the extent of soundings is marked by the change in the colour of the water; as more than once, and particularly in November, 1834, in 25 fathoms of water, to the N.E. off Marowynne river, the colour was perfectly blue and transparent, and at other times tinged of an ashly hue by the mud.

BERMUDAS to the WINDWARD ISLANDS, &c.

Mr. Henry Davy, in his description of the passage of H.M.S. *Cornwallis*, between the Bermudas and the West-India Islands, with the return toward Halifax, in the winter of 1837, states as follows:—

From Bermuda to Barbadoes, instead of steering direct, I would recommend a S.E. by S. course. The advantage of this will be apparent, should the trade-wind be to the southward of east, and it is also a precaution against a leewardly current.

We left Bermuda on the 26th of November, 1837; and, pursuing the above course until fairly in the trade, anchored at Barbadoes on the 6th of December. Made the north end of the island at 4 a.m. at day-light, appearing in a long and very low point. While on the starboard bow Kitridge Point* made equally so, with extensive breakers far out. We rounded the island at a distance of two miles; the coast presenting successive low points, encompassed with breakers, and came to anchor in *Carlisle Bay*.

The *Cornwallis* next passed the Granadines, and the lofty summit of Granada became visible at noon of December 10, as the heavy clouds rolled away to the westward. The ship then proceeded to the anchorage on the S.W. side of Granada. Here, in 15 fathoms, a tide set past the ship to the S.S.W. at the rate of two miles in the hour; at midnight the ship tended, and the tide set through to the eastward, at the same rate. At 8 a.m. of the following day it again made to the S.S.W. and by 10 its rate was three miles. This tide renders the spot valuable as a temporary anchorage.

From the information of the harbour-master it appears that, at the springs the tide here obtains a rate of 4 to 5 knots; that it is strong among the Granadines, at St. Vincent's, and to the southward of Granada toward Trinidad. He was, also, of opinion that, throughout the range of the Caribbean Islands the tides were of more consequence than as hitherto considered; and it appears probable that many of the accounts which reach us, respecting the currents in opposite directions, often in the same place, may be the effect of tides.

At sun-set of the 11th of December, the *Cornwallis*, full of troops, set sail for Halifax. Mr. Davy says, "A fine moon-light evening followed; the ship gliding along the western coast, as we shaped a course for St. Kitt's, which I should always recommend to vessels intending to take the Anegada Channel. At sun-set, Montserrat, Redonda, Nevis, St. Christopher's, St. Eustatius, and Saba, were in sight. At ten we passed between St. Eustatius and Saba, closing Saba to within two miles. When its north point bore west, three miles, steered N.N.W. for Dog Island and Hat Kay. At 3 h. 30 m. in the middle watch, we made the Dog Islands. At 6 a.m. Sombrero bore E.N.E., and at 8 we were fairly clear of the West Indies, and steering away N.W. for Halifax, with the trade-wind at E.N.E. No variation. Thermometer 80°; temperature of the surface water, 78°. From this to the parallel of Bermuda the temperature of the water changed from 78° to 68°. Here, in 33° north latitude, we exchanged the flying fish for the stormy petrel.

The north-westerly winds have a great ascendancy at this period, and prevail over every other quarter. I would, therefore, advise making the most of the trade, and steering away N.N.W. continuing to make as much westing as will insure fetching Halifax with the prevailing wind.—*Nautical Magazine*, July, 1838.

* Kitridge Point is the S.E. point of the island.

PASSAGES BETWEEN JAMAICA AND YUCATAN, CHAGRE, CARTAGENA,
MARACAYBO, &c.

TO THE BAY OF HONDURAS; by the late Mr. JOHNSON CAPES, a constant Trader.

Take your departure from the west end of Jamaica, and steer W.S.W. by compass, until you get into latitude $16^{\circ} 35'$; then run on that parallel till you make the Island of Bonacca, the latitude of which is $16^{\circ} 30'$, longitude $85^{\circ} 47'$, West. (The northern and easternmost part of the island is here meant.) Bonacca is a bold high island, and may be made by night, if required; as I do not know of any danger that extends more than one or two miles off on the north side. Some navigators endeavour to make Swan Islands, but that cannot be of any advantage to them, and is the contrary: for, if you expect to be near them in the night, you get very anxious, as they are very low, and you may run on them before you perceive your danger. I always give them a good berth, that is, keep to the southward; for the current about these islands is very deceiving and uncertain: but, for the most part, sets to the northward and westward. In one of my voyages to the Bay, I was set thirty-four miles to the northward, and sixty-four miles to the westward, of account.

Bonacca ought to be made early in the day, so that you may run down to the middle or west end of Ruatan by the evening, to be ready to take your departure for the Southern Four Kays, at six, seven, or eight o'clock, according to the breeze you have.

If you take your departure from the middle of Ruatan, steer W.N.W. $\frac{1}{4}$ W., making that course good, in order to avoid Glover's Reef to leeward, and on no account whatever run more than forty-five miles from Ruatan before day-light; if you run more than that distance, you are in danger of running your vessel on the reef, where there is no possibility of saving her, for in a short time she will be a perfect wreck. At day-light make all sail possible, and if you do not see the Kays you will soon lift them. The principal kay is called Half-Moon Kay, owing to its having a sandy bay, in the shape of a half-moon; on this kay is the LIGHT-HOUSE, elevated about fifty feet from the surface of the sea; its latitude is $17^{\circ} 12'$ North, and longitude $87^{\circ} 32'$ West. [See Note 20, page 90.] On this kay the pilots live; a set of useful, active, steady, sober, men. These kays ought to be made as early in the day as possible, in order to insure you an anchorage before night.

It frequently happens that vessels, after leaving Ruatan, are becalmed during the night; and, in consequence, they will not make Half-moon Kay before the afternoon. In this case, I would advise the master to brace sharp up, on a wind, and beat to windward all night, tacking every two hours; for, it is to be particularly noticed that, the current sets strongly down on the Southern Four Kays Reef. Several vessels have been lost on this reef, owing to their lying-to; but by keeping the light in sight till morning, it will be sufficient to prevent accident by maintaining your position till you get a pilot, or till you have the day before you.

If it should happen that the pilots are all in BALIZE, (which is very seldom the case,) you must make all sail possible. Keep a man at the mast-head, and you will soon discern a kay, called *Hat Kay*; it is about the size of a long-boat, with trees upon it. You may round the reef, within two or three cables' length, as there is no danger but what you may see, for soundings extend but a short distance from the blue water. After you have rounded the elbow of the reef, steer West, and you will very soon lift the low land of Turneff: at the south end of this marsh is a little Kay, called, by the pilots, *Kay-Bokel*, with several cocoa-nut trees upon it. (Formerly pilots resided on this kay, and now frequently rendezvous here.) You may round this kay by your lead; and, if it be later than three, *p. m.* you must anchor here for the night.

The anchorage is about a mile and a half from the Kay, with it bearing E. by S.; but your lead and your eye is the best pilot for this anchorage. You anchor on a fine white sand-bank; the first soundings you will get is about 10 fathoms; run into 3 or 4 fathoms, clueing your sails up as fast as possible, and giving the vessel at least forty fathoms of cable; for the sand is so very hard, that, with a short scope, you will certainly drift off the bank; then you have no bottom. If this should be the case, you must heave up immediately, and make sail again, to get on the bank.

I anchored here one fine night about eleven *p. m.*, let go my anchor in 5 fathoms, gave the ship thirty fathoms of cable; she never looked at it, but drove off the bank. If it had not been a fine night, I should have been compelled to cut from my anchor. I would not recommend any commander to anchor on this ground with a chain cable; at any other part of the bay a chain is preferable. (This bank abounds with fish.) In the morning, (if you have not by this time obtained a pilot,) get under weigh at day-light, and steer for English Kay.

ENGLISH Kay is situated on the south side of the channel, and is a small, low, sandy kay, with a few thatched houses on it, entirely shaded with trees. It is distinguished by a flagstaff, 60 feet high, for signals, &c. On the opposite side of the channel, that is, on the north side, there is another kay of the same size, called *Goff's Kay*, that has some resemblance of a saddle; at about half a mile to the eastward of which is a little sand-patch, nearly even with the water, called, by the pilots, the *Sand Bore*. This is the place you must anchor at, for it is impossible for a stranger to proceed any farther without a pilot, as we have noticed in page 90.

In case the current, or any other casualty, should set you to the northward of *Half-moon Kay*, and you fall in with the middle of the Southern Four Kays Reef, I would still recommend you to haul the ship to the northward, and go round the north end. On the north end of this reef is a kay, called, by the pilots, *North Kay*; after you round this kay, make all sail for Mauger Kay, the northernmost kay off Turneff: after you round Mauger Kay, steer S.S.W., and you will soon lift English and Goff's Kay; then anchor as before directed.

ON RETURNING FROM THE BAY, I would recommend your taking the pilot as far as Mauger Kay, as I have known many vessels run upon Turneff Reefs, owing to their having discharged the pilots at English Kay. Endeavour to leave Mauger Kay at the close of the day, so as to be the length of the Triangles by day-light. There is a very dangerous reef on the west side of the Triangles, that has picked up many ships.

The current, in general, sets rapidly to the westward, by the south end of the Triangle; a ship should, therefore, never attempt to pass to windward of this reef. On approaching the western edge of the Triangle, keep your lead going.

From the channel within Mauger Kay, if the wind is free, steer north; if not, steer north by east. After you are to the northward of the Triangles, shape your course for Cape Antonio, according to the instructions given in the '*Colombian Navigator*.' From the Triangles the current runs from ten to thirty miles per day to the northward: this I have ascertained from the mean of twelve voyages.

The PRECEDING DIRECTIONS were given by the late *Captain Capes* as the result of many years' experience; but, it may be observed that they make no distinction for the *Season of the Norths*, or northerly winds. The following, therefore, from the journals of *Mr. Dunsterville*, will be the more acceptable.

Directions for Sailing from Jamaica to Balize, in the season of the Norths, or between October and March.

Take your departure from Pedro Bluff or South Negril, keeping near the parallel of 18° N. until you have attained longitude 87° W. Should you then get the wind from N.W. or N.N.W., which winds blow very strong, you will fetch Mauger Kay, the northernmost kay of Turneff, on the starboard tack. Keep well to windward, as the currents in these seasons set strongly to the southward.

Should the commander prefer going in by *Half-moon Kay*, which is, to my astonishment, the route of many, (because the lighthouse serves as a guide,) let it be remembered that the prevailing winds will not, in this season, allow you to lay from Hat Kay Reef to Kay Bokel; and it will also be a dead-beat from thence to English Kay: whereas, on the route prescribed, there is a fair wind direct to English Kay, in a course about S.S.W. 6 leagues. The *Colombian Navigator*, which is an invaluable work for these seas, has been led into this error, directed you to make Bonacca in $16^{\circ} 35'$ and those islands which lie contiguous; but these, being surrounded by dangerous reefs, and not surveyed, must perplex the mariner, with a strong southerly current and constant gales from the northward to N.W., and there being no port into which he can enter with safety, except Port Royal, in Ruatan. The latter is a most desirable place when you are in, but the entrance is particularly narrow and intricate between the reefs.

Half-moon Kay, as already explained, is the S.E. kay of the Eastern Reef, and distinguished by a lighthouse on the east end. To the N.N.W. of this is *Saddle Kay*, about 3 miles distant, with a small clump of trees on it. W.S.W. of Half-moon Kay is *Hat Kay*, which, with trees thereon, resembles a coronet. To three miles S. by E. from this kay extends a dangerous reef, even with the water's edge. The course to clear this reef, from two miles south of Half-moon Kay, is S.S.W. $\frac{3}{4}$ W. about ten miles. From the reef to Kay Bokel the course is West, or W. $\frac{1}{4}$ N., according to the wind, seven leagues.

Kay Bokel may be known by its cocoa-nut trees, and a fine sandy beach. Rounding it at about half a mile, do not approach nearer, as the ground to the southward is foul. If you wish to anchor, bring the Kay to bear from E. by S. to S.E. on a sandy bottom, with 10 to 4 fathoms. Give the ship plenty of chain; otherwise she may drag off the bank.

Should the wind blow strong from the East or N.E. between Kay Bokel and English Kay, at the entrance of the channel to Balize, steer N.W. by W. 4 leagues. English Kay is sandy on the N.E. part, and is bushy to the water's edge on the South and S.W. sides. Goff's Kay, which is on the north side of the entrance, is much smaller, with a cocoa-nut tree on its centre, and is surrounded with a sandy beach. To the eastward of it, about half a mile, is the patch of sand, called the *Sand Bore*; it is even with the surface, and, in rounding it, a great berth must be given. The anchorage is in 8 to 4 fathoms, Goff's Kay bearing from N. by W. to N. by E. or the Kays to the northward, and Goff's Kay in one.

There is also anchorage under Turneff, as far to the northward from Kay Bokel as to bring English Kay N.W. by W. in 4 fathoms.

On English Kay, in general, the pilots live who pilot vessels coming in from the northward.

SAILING OUTWARD.—The course from English Kay to Manger Kay is N.E. by N.; the distance between six and seven leagues. This is the northernmost Kay on Turneff; its latitude is $17^{\circ} 36' 15''$, and longitude $87^{\circ} 47'$. A reef extends from it N.N.W. more than two miles. During two cruises in the Bay the latitude was confirmed.

As the currents in this season run strongly to the southward, half a mile to three-quarters of a mile in the hour, should it blow strong from the northward, on leaving English Kay, run out by the *Southern Four Kays*, as it is very dangerous to beat between Turneff and the main in a dark night. With N.N.W. winds, at this season, it is not unusual to pass out to the southward and eastward of the Triangle.

The DIRECTIONS for VESSELS bound to the EASTERN COAST of YUCATAN, from APRIL to SEPTEMBER, as given by Mr. *Dunsterville*, are as follow:

Take your departure from Pedro Bluff, Jamaica, and pass about two or three leagues to the southward of the Swan Islands. These are two low bushy isles, which may be seen, in clear weather, four leagues off. Between them is a reef over which the sea breaks heavily, and there is not space even for a boat to pass, from North to South, there being but one foot of water over the reef. On coasting along the north side, within a quarter of a mile, I found the coast very clear. About the westernmost island are spots of coral banks, but so clear to the shore as not to endanger a vessel: their extent from East to West is about six miles, the reef included, which extends from the west end, about one mile and a half. There are two sandy coves on the northern side of the western island, and also on the southern side, where boats are safely landed. A current was, however, found on this and preceding days, setting to the N.N.W. about half a mile an hour. I found the latitude, by meridian altitude, $17^{\circ} 24'$, and long. of the east end, by chronometer, $83^{\circ} 48' 50''$. At two miles from this point we had soundings on rocky bottom, with from 9 to 13 fathoms.

From the *Swan Islands* keep in the parallel of Half-moon Kay, or $17^{\circ} 12' N.$, or, as the current sets to the N.N.W., and should it be hazy weather, do not go to the northward of $17^{\circ} 6'$ by account, as it would be very dangerous to fall in with the centre of the Southern Four Kays Reef, at the close of the day. The breezes are generally strong from the eastward with a lee-current. From Half-moon Kay proceed as before directed.

In this season, if, on your return, you pass to the westward of the Triangles, you may find a current setting to the northward about one mile an hour; and it will be found that the winds often shift to the westward, with fresh breezes and rainy weather.

On a voyage of H.M.S. *Bustard*, from Jamaica to and from the Eastern Coast of Yucatan, in June and July, 1827, Mr. Dunsterville made the remarks following:

"From the west end of the Pedro Shoals to the Swan Islands found the current setting to the W.N.W. about one mile an hour. These isles are between three and four miles in extent from E.N.E. to W.S.W., and may be approached (particularly by day) within two miles, in any class of vessel. The *Bustard* passed about a mile off shore on the north and south sides. On the S.W. point is a fine sandy bay, where a vessel may cast anchor in from 10 to 7 fathoms; but, off the west end, a rocky bank extends full one mile and a half, with very irregular soundings, from 10 to 5, 4, and 7, fathoms. When the weather is clear, this bank is easily discovered by the eye. Latitude of the east end of the eastern isle, $17^{\circ} 24'$; off this we had soundings in from 13 to 9 fathoms, rocky bottom, about $2\frac{1}{2}$ miles, the east point N.W. $\frac{3}{4}$ W. No water could be found on the west isle, the swell being too heavy to admit our landing. Hence we proceeded toward Balize.

"At Balize the weather, during our stay, was heavy rains, with tornadoes from S.W. to N.W. These last for two or three hours, then subside into a calm."

On leaving Balize, the pilots are always ready to accompany vessels as far as *Mauger Kay*, and it is imprudent to discharge them sooner, as vessels have been known to run upon Turneff. Vessels from the Turneff Passage should leave Mauger Kay at the close of day, so as to reach the length of the Northern Triangle by day-light next morning if possible.

As the Triangle Reef is very dangerous, great caution is required in approaching it. Most vessels pass to the westward, as the current runs from 10 to 50 miles per day, particularly to the northward; and it generally sets rapidly to the westward, over the reef, and at the south end, on which there is a small sand-bore.

On approaching the southern and western part of the Triangle Reef, keep your lead going. When well to the northward, make the best of your way for your destination, keeping a good look-out in order to avoid the island Cosumel.

Vessels going out by the *Southern Passage*, that is by the Four Kays of the Lighthouse Reef, should never venture without a pilot. In this case the pilot leaves the vessel at Half-moon Kay, which is distinguished by the lighthouse.

"On passing the western side of the Triangle, upon returning from the Bay, we steered N.N.E. and cleared the Kays on the north part; and, having run 30 miles on that course, observed the latitude by the star *Spica* $18^{\circ} 35'$ N. The current set to the northward about one mile an hour, and continued so till we arrived in latitude $22^{\circ} 5'$, and longitude, by chronometer, $85^{\circ} 24'$ W."

From the N.E. end of the Isle Cosumel, Cape Antonio, the western extremity of Cuba, bears N.E. by compass [N. 52° E.] 125 miles. Upon this course allowance must be made, in the southern parallels, for the general indraught into the Mexican Sea to the N.W., and afterward for the stream, which has too frequently been found winding from off Cape Antonio to the E.S.E. as explained in the 'Colombian Navigator' and the former part of the present work.

JAMAICA TO CHAGRE AND OFF CARTAGENA.

Copious Directions for proceeding from Jamaica to and upon the continental coast have been given in the '*Colombian Navigator*.' See Vol. iii., page 191, &c. See, also, the Notes 12, 13, in the present work, page 89. To this information we now add the following, from the Journal of Mr. Dunsterville, 1827.

"Sailed from Jamaica on the 18th of November: the weather fine, with light southerly sea-breezes. In standing across to Cartagena we found the current had set 34 miles to the westward in four days. On approaching land the weather was very hazy.

"We made the land of *Galera Zamba*, [long. $75^{\circ} 25'$ W.] which is low, and appears at a distance, full of hummocks. To the northward of Point Canoas (more to the S.W.) the land is a little higher, and slopes gradually to the point, which is low, and should not be approached nearer than two miles.

"The hill called the *Popa of Cartagena* is very remarkable; it stands to the N.E. of the city, and has a convent on it. This is an excellent land-mark; and, to use the simile of other writers, like the quoin of a gun. From seaward it makes like an island. The city from the ocean has a fine appearance.

"We anchored, in the *Bustard*, on the Playa Grande, in $5\frac{1}{2}$ fathoms, fine black sand, with the convent on the Popa E.S.E. $\frac{1}{4}$ E., Point Canoas N. by E., western extreme of Tierra Bomba, S. $\frac{1}{2}$ W. Latitude of the anchorage $18^{\circ} 28'$ off the town a mile and a half, long. $75^{\circ} 34'$. From hence to Chagre light winds from E.N.E. to North: hazy weather.

"On approaching the land near Porto Bello [Velo] we experienced strong N.E. currents, $1\frac{1}{2}$ mile an hour, and which continued until we arrived off Chagre. Therefore, at this season, keep well to the westward, if the winds are light; but if the strong N.N.E. winds have set in, which commence at about this time, make the land well to the eastward, it not only affording a better land-fall, but the currents then run more rapidly to the S.W.

"In the vicinity of Chagre the land presents nothing very remarkable by which it may be known, particularly if the weather be hazy, and the castle cannot be seen when it bears to the southward of S.E. by S. This castle is situate on an eminence commanding the village and river, and mounts about 20 guns.

"The *Bustard* anchored in $5\frac{1}{4}$ fathoms, with the flag-staff of the castle S.E. $\frac{1}{2}$ E., Point Brujas N.E. $\frac{3}{4}$ N. off shore, three-quarters of a mile. To the southward of the point is a large white patch in the rock, with a fall of fine fresh water close to it.

"Supplies, water excepted, cannot be obtained here. Fowls were a dollar apiece, and scarce.

"In turning down the coast, from Brujas Point to Chagre, which is one league distant, the shore seems bold; but do not shut in the point with the southern land. The best anchorage for a large ship is with the Point N.E. about 3 miles off. A strong current out of the river runs to the N.N.E. two miles an hour at the anchorage, therefore you cannot ride heavy at the anchor; but the vessel rolls heavily when strong winds blow. We weighed and beat to the eastward for *Porto de Naos* or *Navy Bay*, on the N.E. side of which, under Manzanillo Island, a vessel will be well sheltered from N.E. and N.N.E. winds. This bay is formed by *Manzi Point*, the N.W. extremity of the island of Manzanillo, and on the West by *Toro Point*. These points lie nearly three miles from each other. Toro Point has a very dangerous reef, extending nearly a mile to the N.E., which should not be approached nearer than in 6 fathoms. Manzi Point is bold; it has 5 fathoms within half a cable's length, and under it is the best anchorage, at the present season of N.E. winds, in 4 or $4\frac{1}{2}$ fathoms, with Manzi Point North or N. by E. about a quarter of a mile. From the point off shore are 520 yards of good ground. To the distance of a mile or a mile and a half from the entrance the shores are bold, with three fathoms close to the beach, and soundings regularly decreasing from 6 to 4 fathoms. You may, therefore, take an anchoring berth at pleasure, suited to the vessel's draught. This place does not produce supplies of any kind: even water is to be found only in a few stagnant pools, from heavy rains, and is very bad.

"In the season of the rains the best place to anchor in is on the western side, as winds prevail from that quarter. There is a hut on *Point Limon*, in the S.W. extremity of the bay, and which is very high in comparison with the adjacent coast: when it bears S. by W. you will be to the eastward of Toro Reef, and may run into the bay. From this point there is a communication by a path-way to Chagre. Occasionally two or three soldiers are kept there for the suppression of smuggling. Coco-nuts are in great abundance; fish very scarce. The soundings on the coast, from one mile North of Point Toro, to the same distance off Point Brujas, are $7\frac{1}{2}$, 8, $8\frac{1}{2}$, 9, and 10, fathoms; and from Brujas Point to Chagre 10, 9, 7, $6\frac{1}{2}$, 6, $5\frac{1}{2}$, off shore about half a mile, keeping Brujas Point open, bearing N.E. or N.E. $\frac{1}{4}$ N."

JAMAICA TO THE BAR OF MARACAYBO, April and May, 1827.

On sailing from Jamaica we had fresh easterly winds and squally weather, then winds variable round the compass.

From *Alto-vela*, in lat. $17^{\circ} 28'$ N. and longitude $71^{\circ} 41'$, we took our departure for the isle of *Oruba*, on the eastern side of the Gulf of Maracaybo, allowing for the strong westerly currents about three-quarters of a mile an hour.

Saw the *Monks*, which are rocks rather high; and, by the altitude of the star *Antares*, made the northern one to lie in latitude $12^{\circ} 28'$. Hauled to the S.E. and run along the western

western coast of Paraguana, sounding when distant from the shore about three miles, from 12 to 8 fathoms, till we arrived at *Punta de los Estanques*, whence we took our departure for the Bar of Maracaybo S.W. $\frac{3}{4}$ W.

To the Eastward of the Bar of Maracaybo, about 8 leagues, are high mountains; the land westward of these is low, and continues so, with occasional breaks in it, by kays and hillocks, which are at the entrance of the lagoon. Farther westward are two pieces of land, not particularly high, on the low S.E. termination of which are three little hillocks. This is the *Isla Todos*, on which stands the castle of San Carlos. When bearing S.S.W. $\frac{3}{4}$ W. the hillocks are over the fort, which is white. Do not steer for the latter, but continue on about West, not going into less than 5 or $5\frac{1}{2}$ fathoms, when you will open the ruins of Fort Zapara to the southward, and the castle of *Bajo Seco* to the westward, in latitude $10^{\circ} 59'$ and long. $71^{\circ} 42'$. This fortress is, likewise, white, and is situate on a small sandy kay. To the westward of this lies the bar, having at this season a depth over it of only 11 feet, hard bottom; but, in the rainy season, August, September, and October, there is, at least, 13 feet of water.

The breezes here are very heavy from the N.N.E. to N.E. by E. in the early part of the year; yet, at about 8 a.m. the wind is generally more moderate; and from 2 p.m. to 2 a.m. in the following morning, it blows a perfect gale, with a heavy sea, so that it is dangerous to lie at anchor here.

The best anchorage off the bar is in 5 or $5\frac{1}{4}$ fathoms, with the castle of Bajo Seco South or S. by W.; off shore about 3 or 4 miles. The soundings on the south side of the gulf [bay?] are regular, decreasing gradually, as you approach the shore. The current runs to the N.E. when the moon rises, and it is high water, on the full and change, at 5 h. 15 m.

In beating to windward endeavour to be near the north-western shore at about one, p.m., in order to take advantage of the winds which draw to the N.N.E. so as to make a good lay to the eastward.

The communication with the city of Maracaybo is kept up by one of the ship's boats, hiring a pilot for the occasion, who, on making the general signal, will come out from Bajo Seco in a boat with latine sails, should the weather be moderate. If you have to communicate frequently with the city, or to cruise in the gulf, I should recommend beating up to the anchorage of Estanques, in the peninsula of Paraguana; but, in beating up, do not go to the eastward of Punta Gorda, the S.W. point of Paraguana.

The Anchorage at Estanques is very good for a vessel of the largest class, even within half a cable's length of the beach, and capable of containing twenty sail in safety. The best marks for assisting a stranger to find the anchorage is the Mountain (or Pan) of *Santa Anna*, which much resembles Vesuvius, and may be seen, in clear weather, 8 or 9 leagues off. This mountain, when bearing E. $\frac{1}{2}$ N. leads to the anchorage. The place may also be known by being a long tongue of sand, with some huts on the extreme point, occupied by fishermen, who, in the season, take immense quantities of fish by the seine. The Bustard anchored in $4\frac{1}{2}$ fathoms, and veered to 25 fathoms on the N.E. anchor, (from which quarter the prevailing winds come strongly,) and 82 fathoms on the best bower to the S.W. Point Estanques S. $\frac{1}{2}$ E., Point Salines N.N.W. $\frac{1}{2}$ W. off shore two cables' length. No supplies can be obtained here. Rabbits may be shot, but can be purchased cheaply. The little water that may be procured is muddy, and not fit to drink.

If you are bound to the eastward, when clear of the gulf [bay?] stretch to the northward, as the currents run so strong between the Isle of Oruba and Cape St. Roman that it is nearly impossible to beat through; but, should you go between the island and main, be cautious in standing by night to the S.E., as the coast from Cape Roman to Aricula (S.E. 19 miles) is very dangerous, and the currents set thereon.

In stretching across, from Point Chicabacoa, on the west side of the mouth of the Gulf, to Jamaica, we found a strong current, running due West, nearly one mile an hour.

THE CHANNELS OF PROVIDENCE.

The CHANNELS of PROVIDENCE, between the Great and Little Banks of Bahama, are copiously described in the second volume of the '*Colombian Navigator*,' as well as the winds

winds and seasons of this portion of the West-Indies. In pages 65 and 70 of the present work we have also given descriptions of the new light-houses on Gun-Kay, in the Florida Strait, and upon the south end of Abaco, which are eminently useful in facilitating the navigation, more especially since the extinction of the light near Cape Florida, on the opposite side of the stream. We have been assured, by an intelligent navigator, that it is not unusual for twenty sail of vessels, of from 100 to 400 tons burthen to pass the Great Stirrup Kay within musket shot, and even within hail, in one day; these, for the most part, proceeding from the United States to Cuba and the Mexican Sea. They make the Hole in the Wall, now distinguished by its lighthouse, then the Stirrup: thence, if the weather appears threatening they pass through the N.W. Channel; otherwise they shape a course, picking their way, across the Great Bahama Bank to the southward of the Cat Kays, beyond the Gun Kay lighthouse. Here they enter the Florida Strait, and pursue a southerly course, where the Gulf-Stream is found, as described, to run with the least velocity to the northward. See further, '*Colombian Navigator*,' vol. ii. pages xxxvi to xliii, 154 to 158, &c.

III. DIRECTIONS FOR PROCEEDING TO DEMERARY, &c. FROM THE N.E.

In the third volume of the '*Colombian Navigator*,' pages 128 to 160, we have given a copious description of the coast, and directions for making the rivers, of Guyana. To that description, &c. the following remarks in addition, by Captain *Geo. Cheveley*, written in 1831, will be found a useful and valuable addition: see, also, the Notes on Guyana, in the present volume, pages 87, 88.

"If, when in latitude 10° N. the water changes to a dark or black colour, or dirty drab, and then in 8° turns again to the usual sea blue, you may rely on being to windward. There are no soundings, only this remarkable change.* You will then, in running farther in, on the coast, observe a perfect division, or line of change, on the water, nearly N.W., from blue to green, where the current sets strong in that direction. On proceeding, you will again change to thick muddy water, influenced by the tides, which should be carefully calculated and allowed for. Many ships have run to leeward from want of this, and a due allowance in the course when the lee-tide is running, which is always with the flood. As you approach in-shore in 4, 5, and 6, fathoms, should the water then be of a red colour, you may make sure of being to windward, and need not fear running, even should you obtain no pilot. This is most perceptible from Miconie down to Corobana Point: to leeward all is dirty thick mud.

"The lighthouse on the weather point of the Demerary river, shows a fixed bright light to seaward, from 12 to 14 miles; with this light-tower bearing from South to S. $\frac{1}{4}$ W., flood making, you cannot do wrong by steering in on that course, should you not obtain a pilot, and come-to off the Fort, keeping outside the poles on the west side. I mean this as a safe plan for a stranger.

"The deepest part of the channel has worked of late much to windward; and deepened so as to allow vessels of 17 and 18 feet draught to beat out in two or three tides. I ran in without a pilot in April, 1830, was on the bar at dead low water spring-tides, least water 2 fathoms, and am convinced 11 feet may always be found. The pilots, of course, wish the bar to be thought shoal and dangerous, and wish to keep in ignorance those who should make these things more a matter of study than is at present the case."

To the preceding we now add the following, obligingly communicated by Captain *Wm. Cook*, of the *Highbury*, of London, 1834.

Ships from Europe, bound to Guyana, on arriving in about the latitude of 10° N., longitude 48° to 50° W., will suddenly find the water change from a light blue to a dark green colour, (no soundings with 130 fathoms of line,) with every visible appearance of a strong current. This current, from repeated observations, I have found setting to the northward at the rate of a mile and a quarter per hour; and, in the months of August and

* This discoloured water appears to be in the stream of the *Equatorial Current*; as may likewise be that which is met with at 80 or 100 leagues to the East of Barbadoes.—ED.

September, (after the rainy season,) I have found it to set about N.N.E., at the rate of two miles an hour. I consider this current to be caused by the stream of the River Marañon; for as you proceed to the S.W., the water again resumes its usual colour, and the current takes a more westerly direction, until you reach the edge of the Bank of Soundings, where it takes the direction of the line of coast, and runs at about a mile and a half in the hour, excepting during and immediately after the rainy season, when it runs at the rate of from 2 to $2\frac{1}{2}$ miles an hour.

Strangers bound to Demerary or Berbice, (if not quite certain of their longitude,) should avoid making the land, and endeavour to gain the parallel of $6^{\circ} 30' N.$, before going to the westward of longitude 56° . The course then is W. $\frac{1}{2}$ S. by compass. To the eastward of the River Corentyn, in this parallel, you will have from 18 to 20 fathoms of water, dark sand, with broken shells and mud; when abreast of the Corentyn, you will have 12 fathoms, with clean brown sand. Steering the above course, you will gradually shallow your water to 7, 6, and 5, fathoms, soft mud, when you may be sure that you are approaching the Bar of Berbice.* If it be day-light, you will see the land, which is very low. If in the night, and you are bound to Berbice, I would advise the ship to be brought to anchor.

If bound to Demerary the better way will be to stand to the northward by the wind until daylight, as there are several dangerous mud-flats between Berbice and Demerary, some of which extend 6 or 7 miles off the land, and shift occasionally.

WINDS.—During the day, throughout the greater part of the year, the prevailing winds on this coast are from the N.E. to N.E. by N. During the months of June, July, August, and September, the wind generally draws more to the eastward after sun set, and continues blowing light until about 9 o'clock in the morning; when it again backs to the N.E., and blows a fresh breeze.

CURRENTS.—Within 15 miles of the coast the tide regularly ebbs and flows six hours each way; the flood running westward and ebb to the eastward. Without this range the Current [Equinoctial] runs constantly in the direction of the coast, from one to two miles an hour. In sailing to the northward you will find the current, when about 60 miles from the coast, to run about N.W., and in this direction it continues to run until you are to the northward of the islands. (See page 184.)

“The velocity of the current, between the coast of Guyana and the islands, is modified by circumstances, which I have never been able satisfactorily to account for, as I have often found it imperceptible; at other times very strong, and not in the least influenced by the seasons.”

IV. OF SHIPS BOUND TO AND FROM NORTH-AMERICA ONLY.

By referring to the chart it will be seen that, from the Land's End of England to St. John's Newfoundland, the true bearing is W. $4^{\circ} S.$; and, from the same point to Cape Sable, or the S.W. end of Nova-Scotia, it is about W. $9^{\circ} S.$ But the circumstances of navigation, in general, render a direct course more tedious and difficult than a circuitous route; and the best passages have been made by pursuing a high northerly course.

It seems probable, from all that we have said on the Winds and Currents, that, on prosecuting a north-westerly course, from the Bank of Channel Soundings, the Winds and Currents, respectively, may counteract and balance each other: that, on a farther prosecution of the same course, the winds will be found less westerly, and therefore more favourable, than in the more southerly parallels; and that, in advancing toward the mouth of Davis's Strait, the advantages both of wind and current may be combined.

Caution must be taken not to advance too near the Eastern coast of Newfoundland, if bound to New Brunswick or the Southern ports; nor to the Eastern Coast of Breton Island, as here the vessel may be swept round by the strong westerly currents, which have been described on the preceding pages, (222-227,) and which, now understood, instead of producing mischief, may prove highly advantageous in facilitating the ship's course.

* Since the 5th of February, 1840, a light-vessel has been stationed off the Berbice, in $2\frac{3}{4}$ fathoms at low water, with the eastern point of the entrance bearing S.S.W. distant ten miles. It exhibits a single bright light, from sun-set to sun-rise, and by day a black ball at the mast-head. For the light-vessel of Demerary, see the note 8, page 88. It may be prudent not to depend too much on seeing these vessels when passing.—ED.

The propriety of these arguments was confirmed by experience, in more than forty passages made to and from New Brunswick, &c., by Lieut. Chas. Hare, of the Royal Navy, previous to the fall of 1824. Annexed is a copy of that gentleman's communication.*

"Ships from Scotland, in the spring of the year, and bound to New Brunswick, have always arrived sooner than those from the English Channel, which is attributed to their being more to the northward on leaving the land.

"Ships from Liverpool generally arrive before those which sail from the English Channel, the cause being the same.

"In the SPRING of the year, I would never go to the southward of latitude 46° or 47° until I reached longitude 37° or thereabout; then edge to the southward as far as latitude 43° in order to avoid the ice-bergs, keeping a very strict look-out; this parallel (43°) I should endeavour to preserve, or nearly so, but nothing to the southward, until up to Cape Sable, Nova Scotia; for it carries you to a safe and proper distance from Sable Island, a place that cannot be too much dreaded. In this track you will be without the northern edge of the Gulf-Stream, and assisted by a south-westerly current from the banks until past that island.

"In the FALL of the year my track is far more to the northward than in the Spring. On leaving the land as late as the middle of October, or thereabout, I generally steer to the north-westward until I get as far North as 55° , and until I enter the longitude of 30° , then edge to the southward, to enter the Banks in latitude 46° , shaping again a course to pass about sixty miles to the southward of Sable Island, as above. If bound to Halifax, and very sure of my latitude, I might be tempted to pass to the northward of Sable Island; but, at all events, it would be at great risk; and I should not, under any circumstances, recommend a stranger to attempt it; as the weather is mostly foggy, and the set of the currents unaccountable. The soundings on Banquereau are incorrectly laid down in every chart that I have yet seen; being, in fact, within one hour's sail of the N.E. Bar of Sable Island, from which cause I once very narrowly escaped shipwreck. Numerous gannets are always hovering about this island, and are a very excellent indication of your near approach to it, particularly on the south side.

"By crossing the Banks thus far North, you will find the advantage as you approach the longitudes of Newfoundland and Nova Scotia; the strong N.W. and North gales having then commenced, you will frequently be compelled to lie-to for two or three days; and should then insure sufficient drift, before you are blown into the strong influence of the Gulf-stream; which would be the case at a few degrees to the southward, and inevitably in a S.S.E. direction, at an inconceivable rate. Last November (1824) the case occurred: the vessel being hove-to, under main-topsail and storm-trysail, to the westward of the Banks, in latitude 45° , and was, in four days, swept into latitude $39\frac{1}{2}^{\circ}$, consequently into the Gulf-stream, when the longitude became also considerably affected, and I took the first opportunity of making a N.N.W. course, to get out of it as soon as possible.

"To prove the advantages of a northern track, late in the fall of the year, I may notice that I have, in one or two instances, read, in the American newspapers, the accounts of very long passages experienced by ships which met heavy gales in the latitudes of 35° and 38° , when several vessels were disabled, and others suffered loss of sails; yet, *on the same day*, in latitude 54° , I had moderate weather from the N.N.E. with top-gallant studding-sails set; which strongly encourages me to believe that the blowing weather, incident to approaching winter, commences southerly, and inclines northerly as the season advances, and not the reverse; an hypothesis generally formed by English ship-masters, but, in my opinion, certainly erroneous.

"I am farther of opinion that the influence of the Gulf-stream, in the parallels from latitude 35° to 42° , whether from the warmth of the water or other natural causes, has a strong tendency to attract the wind from a western direction; as I have invariably found the wind more alterative in the northern latitudes before mentioned than the southern ones; and it unquestionably must be allowed, by all mariners of any observation, that gales expe-

* Many succeeding passages made by Capt. Hare, since 1824, have concurred to prove the propriety of these directions, which have been highly approved by the American captains of home ships, as well as by British masters. This gentleman had crossed the Atlantic, for the *ninety-eighth* time, in the year 1839.

rienced in the Gulf-stream, or its vicinity, blow with much greater violence than they do in that part of the northern Atlantic not under its influence; besides, the squalls from the southward or S.W. are much more sudden and heavy, and near the Banks they are attended with dangerous lightning. The thermometer (an instrument easily understood) is of the greatest importance for ascertaining your approach to it; and, if bound to the west, I would, for my own part, endeavour to avoid its effects as cautiously as I would a lee-shore; for it may be depended on, that no ship, however well she may sail, will effect westing in the Gulf-stream with a wind from that quarter; and it is to be remembered that its velocity is accelerated according to the strength of those winds; and its extent in breadth, at a few degrees to the westward of the Azores, is many more degrees than is commonly supposed.

"These observations, I hope, may be useful to my brother mariners engaged in these voyages; and, permit me to say, that they are grounded on the experience of more than forty times crossing the Atlantic, in his Majesty's and the merchant service, and in the command of vessels in both; latterly in one of nearly four hundred tons burthen, the *Waterloo*, owned in St. John's, New Brunswick; and, as the Custom Books in Liverpool can testify, landed four full cargoes in thirteen following months; which, including the time required to discharge the same, then load outward to St. John's, there discharge and load home again, leaves but very little time for the ship to cross the Atlantic eight times in fourteen months, which in fact, was done.

"Still further, in corroboration of my approved northern track, allow me to observe that, in the fall of 1823, by keeping in a high latitude, the brig *Ward*, myself master, also owned in New Brunswick, performed a voyage out and home, in seventy-two days. The same vessel likewise, on the 3d of October, 1824, left the English Channel, and arrived again in the Downs on the 3d of January following.

"I must add that, a strong well-found and well-manned vessel alone can perform these voyages; for they must be maintained with unremitting attention and perseverance.

"The necessity and propriety of the above remarks was particularly exemplified by the *Ward*, which, on her passing through the Downs, in 1824, left ships there which were bound to the westward, weather-bound, and found them there on her return, having been driven back by adverse winds; while she, getting out of the Channel, performed with ease a prosperous voyage to St. John's, New Brunswick, and back, exactly in three months, assisted by chronometer, thermometer, &c."

Although the voyage to and from North America, between the parallels of 60° and 40° , has always been attended with a degree of peril, from masses of ice which drift to the southward, during the summer months, from the polar regions, yet many an unwary mariner makes his run across the Atlantic without any apprehension of meeting these floating dangers, or without sufficiently exercising a proper discretion and vigilance to guard against coming in collision with them. Commanders of ships should, therefore, bear in mind the imperative necessity there is for using their utmost vigilance and attention when crossing the above named parallels, especially between the meridians of 30° and 60° W. to guard against coming in contact with these formidable dangers of the ocean.

The *New York packet ships*, well supplied with every essential equipment, and elegantly fitted for the accommodation of passengers, when making their winter voyage from Liverpool, keep in high latitudes until nearing Newfoundland. This they do for the two-fold object of avoiding the tempestuous weather so generally experienced to the southward, and of obtaining fairer winds; and thus, by slipping within the mighty stream from the Florida Channel, they evade its retarding influence. The voyage by this route is shortened; and, although bad weather must be expected, it is not so violent as farther South; besides which the eastern currents are avoided.—See further, on this subject, 'Colombian Navigator,' Vol. I. page 219.

GULF OF ST. LAWRENCE, &c.—Those bound to the Gulf of St. Lawrence, after passing to the southward of the Virgin Rocks, on the Grand Bank, and the Island of St. Pierre, should keep a middle course between Newfoundland and Breton Island; not forgetting what has been heretofore said on the Winds and Currents (pages 109 and 223.) Recollecting also, that the harbours on the coast, westward of Fortune Bay, are impeded with dangers; there are many rocks about the entrances, and most of the harbours are imperfectly known. The rocks are not to be seen in thick weather, and fogs very much prevail on the coast.

COMMANDERS OF VESSELS BOUND TO THE GULF OF ST. LAWRENCE will do well to observe that, off the South coast of Newfoundland, between the meridians of 55° and 56° , and the parallels of $45^{\circ} 20'$ and $46^{\circ} 15'$, is a deep gully in the sea, extending in a true N.N.E. and S.S.W. direction, and separating the Bank of St. Pierre from the Green Bank. *The method adopted by the French vessels bound to St. Pierre, for making that island, is as follows :—*

From the longitude of 52° W., in lat. 45° , they steer a N.W. course by compass, which carries them across the Green Bank, in 48 fathoms of water; and when on the meridian of $55^{\circ} 10'$, in about $45^{\circ} 35'$ N., they suddenly deepen their water, from 45 to 90 fathoms. A further run on the same course, of about ten miles, carries them across this gully, when they shoalen their water again to 35 and 30 fathoms; and, after a farther run of 23 miles, they steer about N.N.E. directly for the island, and seldom or never miss it. (*See the Chart.*)

Those who have lost their reckonings, on finding this gully, which may be known by the water shoaling on the east and west sides of it, an experiment that is frequently made for ascertaining whether they are actually in it or not, may safely take it as a *fresh departure*. Commanders, not being aware of it, when they have found their water deepen from the Green Bank to the westward, have imagined themselves entering the Gulf of St. Lawrence; and, by steering a course too far to the *northward*, have been lost to the eastward of Cape Ray, on the rocks of Newfoundland. The length of the gully is about sixty miles, in a true N.N.E. and S.S.W. direction, and the middle of it is in the latitude $45^{\circ} 50'$, and longitude $55^{\circ} 15'$.—*Communication of the French Commandant to Capt. Sir Rd. Grant, R.N., 1833. [Corrected.]*

The little island of St. Paul, which lies to the north-eastward of Cape North, now distinguished by its lighthouses, is bold-to, steep, and high; and, with a good look-out, in the day-time, cannot be considered as dangerous, even in thick weather. The land of Breton Island is very high, and though fogs are about it frequently, it is seldom so much obscured as not to be seen in time. On entering the Gulf, the Magdalen and Bird Islands will be seen, as they lie in the direct course from Cape North to the River of St. Lawrence. [*See Notes 1 and 2, page 48.*]

There is, in clear weather, a safe passage between the Bird Islands and the Magdalens; but, in thick weather, it is adviseable to keep either to the southward or northward of both, as the wind may permit.

In Pleasant Bay, on the S.E. side of the Magdalen Islands, there is clear and good anchorage, very near the shore; and it is a very safe place for vessels to ride in, with a westerly wind, and infinitely preferable to beating about in the Gulf with a foul wind. There is a safe passage into it between Amherst Island and Entry Island.

As the weather to the southward of these islands, between them and Prince Edward Island, is generally much clearer than on the North, the passage that way is preferable, particularly after the early part of the year, when S.W. winds mostly prevail.

See further, our Directory for the Coasts of Newfoundland, &c. and 'Colombian Navigator,' Vol. I., page 85, note (*).

UNITED STATES.—The course of ships bound from Europe, to the ports of the United States, is controlled, in a great degree, by the operation of the Florida-Stream, as we have already shown. Little therefore, requires to be added to the subject here. Those bound to the northern and middle ports, when passing the shoal grounds on George's Bank, should take care to pass between these shoals and the Stream. Also, when passing the Nantucket Shoals, to keep between them and the Stream. (*See the Description of Shoals, &c. hereafter.*)

By taking this precaution, so as to keep between the Stream and shoals, a ship may shorten her passage to New York, Delaware, Virginia, &c.; for she will have, *mostly*, in this track, the advantage of an eddy current running contrary to the Stream, when the latter would retard her progress at the rate of 60 or 70 miles per day.

Ships crossing the Stream, when bound to the westward, must get over as quickly as possible; or, it is clear, that they will be carried far out of their course.*

It

* The following Notice relative to several short Passages across the Atlantic was given in a Liverpool

It has been remarked that, "ships from sea, approaching any part of the American coast between Long Island and Cape Hatteras, if in doubt about their reckoning, should take notice of the Gulf-weed, which is in greater plenty, and in larger clusters, to the eastward of the Gulf-Stream than in it, where frequently, though not always, the sprigs are but small and few.

The outer edge of the bank off this part of the coast appears to be very steep; for it has been frequently found that, while the lead has been kept going, there have been found 45 fathoms, soon after 35, and a mile nearer shore only 25 or 20, fathoms; from these depths the shoaling to the shore varies in different directions.

The soundings along the New Jersey coast are the most regular, as the water there shoalens from 35 fathoms on the outer edge to 10 or 12 fathoms in sight of land, and thence to 7 fathoms near the shore; excepting only from two leagues south of Shrewsbury Inlet to the Bar of Sandy Hook, where the water is deeper. Here are 10 fathoms near the shore, and deeper farther out, with some patches of rocky bottom. In latitude 39 deg. 24 min., the outer edge of soundings lies 19 leagues from shore, and E.S.E. from Great Egg Harbour, 18 leagues.

For the WINDS on the South-eastern Coasts of the United States, see page 111.

MONITIONS and INSTRUCTIONS for vessels navigating on the WESTERN SIDE of the ATLANTIC; by Mr. Redfield, of New York. (*Abstracted from the American Coast Pilot, 1833.*)

1. Between the latitudes of 32° and 45°, (the parallels of Georgia and Nova-Scotia,) a vessel bound to the *eastward*, on being overtaken by a gale which commences blowing from any point to the eastward of S.E., or E.S.E., may avoid some portion of its violence by putting her head to the northward, and when the gale has veered sufficiently in the same direction, may safely resume her course. But, by standing to the southward, in like circumstances, she will probably fall into the heart of the storm.

2. Within the same region, a vessel, on being taken in a gale from S.E., or points near thereto, will probably soon find itself in the heart of a storm; and, after its first fury is spent, may expect its recurrence from the opposite quarter. The most promising mode of mitigating the effect of its violence, and at the same time shortening its duration, is to stand to the southward upon the wind, so long as may be necessary or possible; and if the movement succeeds, the wind will gradually head you off in the same direction. If it becomes necessary to heave-to, put your head to the southward; and, if the wind does not veer, be prepared for a blast from the north-west.

3. With the wind at East or N.E., a vessel, by *scudding* in a gale, shortens its duration. By scudding, on the contrary, before a south-westerly or westerly gale, you will thereby increase its duration.

4. A vessel, on pursuing her way to the westward or south-westward, meets the storms in their course, and thereby shortens the periods of their occurrence; and will encounter more gales, in an equal number of days, than if stationary, or sailing in a contrary direction.

5. Vessels, on the other hand, while sailing to the eastward or north-eastward, or, in the course of the storms, will lengthen the periods between their occurrence, and consequently experience them less frequently than vessels sailing on a different course. The difference of exposure which results from these opposite courses, on the American coast, may, in most cases, be estimated as nearly two to one.

6. The *Barometer*, whether in the higher or lower latitudes, always sinks while under the first portion or moiety of the storm on every part of its track, excepting, perhaps, its

pool Paper, January, 1824, and affords a pleasing demonstration of improved knowledge in the navigation of this ocean.

"The packet-ship *New York* arrived here on Thursday last, after one of the shortest passages, we believe, yet made between New York and this port. She sailed on the 16th of December, and arrived here in the morning of the 1st of January, being little more than fifteen days. The *Mary Catharine*, which left Charleston on the 16th of December, made her voyage, from port to port, in nineteen days. The *Marmion* arrived in the evening of the 7th of January, in eighteen days from Charleston, and two more from that town." The winds, &c. must, of course, have been favourable. Many similar instances, of subsequent date, might be added, and we can hardly forbear flattering ourselves that many have been facilitated by the information and instructions contained in the present work.

extreme northern margin, and thus often affords the earliest and surest indication of the approaching tempest. The mercury always rises again during the passage of the last portion of the gale, and commonly attains the maximum of its elevation on the entire departure of the storm.* The indications of the barometer ought not to be neglected, even should the fall of the mercury be unattended by any appearance of violence in the weather, as the other side of the gale will be pretty sure to take effect, and often in a manner so sudden and violent as to more than compensate for its previous forbearance. The prognostics engraved on the scale are not to be regarded: the mere *rising* and *falling* of the mercury are the particulars to be attended to.

7. The vicissitudes of winds and weather which do not conform to the implied specifications, are more frequent in April, May, and June, than in other months. Easterly or southerly winds, under which the barometer rises, or maintains its elevation, are not of a gyratory or stormy character; but such winds frequently terminate in the falling of the barometer, and the usual phenomena of an easterly storm.

STEAM NAVIGATION ACROSS THE ATLANTIC.

The first steam-ship which crossed the Atlantic, was the *Savanna*, commanded by Moses Rogers, which was built at New York, in 1818, and which left the port of Savanna on the 25th of May, 1819. She anchored at Liverpool on the 25th of June, left that port for St. Petersburg on the 23rd of July, and arrived at Cronstadt October 6. On the 30th of November she again anchored at Savanna, having on her return voyage stopped four days at Copenhagen and four days at Arendal in Norway. During the whole of this period she met with no accident except the loss of a small boat and anchors.

The *Savanna* sailed to Europe twice, and her Captain, Rogers, was complimented with several handsome presents from the Emperor, the Grand Signior, &c.

The celebrated British steamer, for the ports of America, "*The Great Western*," of 1340 tons, was launched at Bristol, July 19, 1837, and proceeded from that port, for New York, under the command of Lieut. Jas. Hoskins, R.N., on the 8th of April, 1838.† Taking the usual route, she was on the eastern edge of the Newfoundland Bank, at noon on the 17th, in lat. $44^{\circ} 10'$, and, proceeding to the S.W., left the southern edge on the 18th, in lat. $42^{\circ} 58'$. Passing northward of the Gulf-Stream, she arrived at New York on the 23rd, amid the plaudits of innumerable spectators and every demonstration of joy. The journalist says that "the moment of her arrival was an exciting moment which, in the tame events of life, finds few parallels; it seemed to be that of the out-pouring congratulations of a whole people, when swelling hearts were open to receive and to return them. It was a moment that, if both nations could have witnessed it, would have assured them that, at heart, there is still a feeling and an affinity between them. It was a moment of achievement! we had been sharers in the chances of a noble effort, and each one of us felt the pride of participation in the success of it, and this was the crowning instant."

V. ROUTES TO AND FROM THE SENEGAL AND GAMBIA.‡

Whatever may be the season of the year, it is advisable to gain an offing of twenty-five leagues to the westward of Cape Finisterre; from hence it may be immaterial whether a course be shaped to the eastward or westward of Madeira. A commander desirous of touching at the Canaries will adopt the former, and will shape a course for Tenerife, having nothing to apprehend on this course but the Salvages, the position of which has been well determined. In the Canarian Archipelago, the winds are mostly from North to N.E. If the course to the westward of Madeira be adopted, a vessel will make the westernmost of the Canaries only, and her place may be rectified by a sight of Palma or Ferro:

But a sight of the Coast of Africa is by no means necessary for vessels bound to the Senegal or Goree. What has been said of the currents and prevailing winds in this navigation, leaves no doubt that it is perfectly useless to make the land more than fifteen or twenty leagues to the northward of the Senegal, when bound to the bar-anchorage. This

* See upon this subject the Appendix hereafter.

† The dimensions are given in the *Nautical Magazine* of October, 1837.

‡ Abridged, chiefly, from the Baron Roussin.

digression is the utmost which should be made from the above course, and by means of the lead and some few latitudes carefully observed, it might even be made a direct one. On leaving Tenerife, the course should be S.W. $\frac{3}{4}$ S. [*S. by W. $\frac{1}{2}$ W.*] as far as the parallel of 21° , then S. by W. $\frac{3}{4}$ W. [*South*] as far as 20° , and from thence S. by E. $\frac{1}{4}$ E. [*S.E. by S.*] without any further alteration.

The first course will carry a vessel more than twenty-five leagues from the nearest point on the African Coast, and in a track where no danger has hitherto been found: The second will conduct her twenty-six leagues to the westward of the westernmost point of the bank of Arguin: By the third she will make the Coast in the neighbourhood of the *Marigot or Lagoon of Mosquitos*, (lat. $16^{\circ} 35\frac{1}{2}'$) from whence she may coast the shore until abreast the Senegal, in $15^{\circ} 55' N$.

If it be found necessary to make the land during the night, the lead, being the only means of correcting the estimated run, should be used frequently and with great care. At about ten leagues from the shore to the northward of the Senegal, a bottom of white sand will be found, with 70 fathoms. From thence the depth gradually decreases toward the shore, and at one mile from it there are 7 or 8 fathoms. When in 15 fathoms of water, it is advisable to anchor until day-light, to avoid running past the Bar, which has no distinguishing mark by night.

There is a source of error attached to the navigation of the African Coast which must be carefully guarded against. It is the optical illusion caused by the great horizontal refraction, which renders any correct estimation of distance almost impossible. Numerous instances of it might be cited, which would hardly be credited; therefore the moment the coast is seen, the lead only should be trusted, to determine the distance from it.

TRACK FROM SENEGAL to GOREE.—The *Almadies* of Cape Verde, (described hereafter,) are 31 leagues S.W. by W. $\frac{1}{4}$ W. [*S. 40° W.*] from the Roadstead of the Senegal, and the prevailing currents set nearly on that bearing; it is, therefore, the course to be steered from the Senegal to Cape Verde during the day. During the night steer a quarter of a point more westerly. From Cape Verde to Goree the course is direct. It is merely to coast the shore at the distance of two miles. From Cape Verde to Cape St. Mary, at the mouth of the Gambia, the direct course and distance are S. by E. $\frac{1}{4}$ E. [*S.E. by S.*] $30\frac{1}{2}$ leagues, in all which space soundings may be found.

RETURN TO EUROPE.—The voyage from the Senegal to Europe presents no difficulty, and calls for no other precautions than those commonly used in long voyages, on seas void of dangers. These precautions are, not to trifle with the wind, but rather to make a good run in a given time, than to endeavour to make good the proposed course. In all return voyages from places within the Tropics, the grand point is to leave the region of the trade-winds, and get into the variables, and the currents setting to the eastward, as soon as possible. As the winds generally blow from East to N.W. on the Coast of Africa, from the month of December to the end of June, you should keep on the starboard tack until out of their influence. The course made good will be about N.W., and you will then be in the neighbourhood of the Azores. It is immaterial whether you pass to the northward or through the channels of these islands, but it has been remarked that the winds are strongest on the westward. It is seldom possible to pass to the eastward of them. The distance no doubt would be shortened, but this passage can be effected only by keeping close to the wind thus far, and experience has proved that, by such procedure, little is to be gained.

VI. GENERAL INSTRUCTIONS and ADMONITIONS for Vessels bound from LIVERPOOL and other WESTERN PORTS to the ATLANTIC OCEAN, and for returning from the Ocean to the same: By Captain THOS. MIDGLEY of Liverpool, 1839.

"Many Shipmasters have been bewildered in St. George's Channel, especially in thick weather, from ignorance of the Tides and want of experience; some we are sorry to add, from want of due consideration, and others from not allowing for the indraught into the Bays on the Welsh coast.

"The writer of the following hints and observations begs to be understood as laying no claim to merit in their compilation; his only motive being to assist and advise the *stranger*, and those who, from want of experience, have acquired only a slight knowledge of this dangerous navigation." The Instructions are arranged as follow:—

1. On proceeding from Liverpool westward to the Bay of Holy Head.
2. On taking the North Channel and proceeding thence to Tory Island.
3. On proceeding by the South Channel, and thence westward to the Ocean.
4. On proceeding by the South of Ireland from the Ocean to Liverpool, &c.

(Throughout the whole of this paper the courses, bearings, and state of the winds, &c. are to be understood as by compass.)

1. ON PROCEEDING FROM LIVERPOOL WESTWARD TO HOLYHEAD.

Before proceeding with Captain Midgley's paper, we have to notice that the *Light houses* and *floating lights* in this track, as enumerated in pages 10 and 11, taken in succession from East to West, as they stood in 1839, 40, were as follow :—

LIGHTHOUSE near **CROSBY POINT**, on the eastern shore of Liverpool Bay, with fixed light of a *red* colour, which unmasks on the bearing of S. by E. $\frac{3}{4}$ E. : this lighthouse, with the beacon surmounted by a ball, and a floating light, painted red, with a black ball by day, lead into the *Victoria Channel*, a swashway which has lately been formed by the tides, between the Burbo and Jordan Banks, with the assistance of dredging machines; but it is doubtful how long the passage may continue in its present direction; as the *New Channel*, formed and buoyed in 1837, is already nearly grown up, owing to the shifting of the sands.

The **BLACK ROCK LIGHTHOUSE**, at the entrance of the Mersey, on the west, has revolving lights, two brilliant, and one red, at intervals of a minute. (Page 10.) Westward of this, on the Cheshire coast, stand the *Leasowe* or *Lizza lights*; within which is the lighthouse on *Bidston Hill*, and farther west the *Hoylake lights* on the shore near Helbre Point.

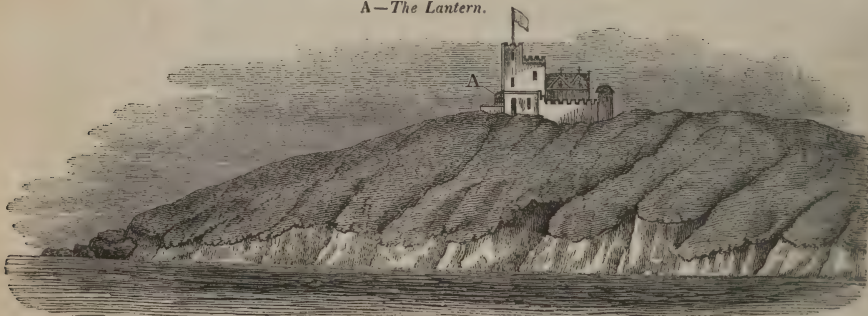
The **LIGHT-SHIP** in the centre of Liverpool Bay is eminently useful as a guide to the different channels. It shows three bright lights, as noticed in page 11, and its figure, with those of many other marks, is given in the New Directory for St. George's Channel, &c. but, in lieu of a flag, a large black ball is now hoisted at the main-mast head.*

Next to the Lighthouse on the *Point of Air*, the N.W. point of the mouth of the Dee, (striped red and white horizontally,) at the distance of 25 miles, is the *Menai tower*, upon *Twyndu* or *Black Point*, on the west side of the entrance of Beaumaris Bay, with a fixed *red* light. Then follows the flashing or intermitting light on *Lynas Point*, which is seen between 6 and 7 leagues off. The next remarkable light is that of the *Skerries* near Anglesea, with its fixed light, and the last is the revolving light on the South Stack, near Holyhead. All of which have been described.

POINT LYNAS (Elianas?) the N.E. promontory of Anglesea, is the western station of the Liverpool pilots. Its lighthouse and telegraph, supported by the dock-trust of Liverpool, is, says Captain Denham, the accustomed finger-post, or positive point of departure, properly sought for by the mariner seeking a pilot for Liverpool, &c.

It

A—The Lantern.



Appearance of Point Lynas and Lighthouse, when nearing it from the Westward. (Capt. Denham.)

* The vessel lies in 7 fathoms at low water, and from being the outer beacon object of the port, is called the *North-west Light-ship*; the hull is bluff-built, with a short bowsprit, and painted black. The

It has been observed, by *Lieut. Thos. Evans, R.N.*, a gentleman intimately acquainted with this coast, that near Point Lynas there is neither anchorage nor shelter when the wind blows from the N.W., and then it is with difficulty that the pilot keeps his station, especially in long winter nights; and even when the wind blows from the southward, vessels bound up for Liverpool often round the Skerries too suddenly, and are carried on the *Coal Rock*, where they perish and are never more heard of: whereas others, more apprehensive of the danger, keep *too great an offing*, and thereby miss the pilot, notwithstanding the vigilance of the latter. *Piloting Directory for St. George's Channel, &c.*, page 52.

We now revert to Captain Midgley's Instructions:—

"*Liverpool* being the principal and central port in St. George's Channel, and the prevalent winds being from the Westward, W.S.W., and S.W., during 8 or 9 months of the year, I shall suppose that a large ship leaves that port, with an adverse wind, from the westward. Having discharged the pilot off the light-ship, stand to the northward all the ebb tide, (which in Liverpool Bay sets to the N.W. and the flood to the S.E.,) and, if laying N.N.W. or to the westward of this direction, during the first quarter of the flood, keep the lead occasionally going, with a careful look-out for the Isle of Man, which is moderately high, and on the South side bold-to.

Should there be a strong breeze and a heavy sea, the vessel may not weather the West Hoyle Sands, on the starboard tack; and great caution is, therefore, required when going near them, as they are bold-to and very dangerous. In thick weather the lead must be constantly used, and the sands should not be approached nearer than in 10 fathoms of water.

The soundings along the north coast of Wales, eastward of Point Lynas, will pretty accurately determine the distance of the ship from the land, provided due attention be paid to the *depth* of water, but the *quality* of the soundings will not indicate the particular part of the coast she may be abreast of.

The "*Ormes Heads*" are very bold, and any vessel may safely steer a direct course from thence to Point Lynas, which may be known by the castellated building near its extremity, used as a lighthouse, and its telegraph station upon the summit.

Point Lynas and the land to the westward of it is very bold, but the ebb-tide hence runs very strongly to the W.N.W. and through the Sound inside the Skerries. Off the Middle and West Mouse the spring ebbs run at the rate of seven knots; and all vessels should, consequently, give this part of the land a good berth during light winds, at such times as the flood or ebb may be running strong; or they may, upon an ebb-tide, get into the vicinity, or perhaps upon, the Coal Rock or the Skerries Platters.

The Coal Rock bears E. $\frac{1}{2}$ S. $2\frac{1}{2}$ miles from the Skerries, and lies with the West Mouse (a large rock, always high above water,) on with the two Beacons on Carnel Point. The Platters are nearly the whole length of the Skerries Rocks, and lie at about one-third of the distance between the Skerries and Carnel Point.

BEAUMARIS is a good harbour for all ships, into which a Liverpool pilot will conduct them, provided no licensed pilot for the port may be found; but the Beaumaris pilot-boat is generally cruising off the chops of the bay, between the Ormes Heads and Lynas, or lying at anchor within it.

HOLYHEAD is also an excellent harbour; large ships must lie aground, in about 14 feet at low water, but they will be quite as safe and as free from damage as in the Liverpool docks. Great caution and good management are required, however, in entering this harbour, which must not be attempted without a pilot, if one can possibly be procured.

On coming round, by the South Stack or the Skerries, into the chops of Holyhead Bay, make known your intention of coming into the harbour by making the usual signal for a

The lights are from lanterns fitted around the masts, with 8 lamps and reflectors in each, appearing in the order of fore, main, and mizen, tops, elevated respectively at 32, 40, and 26, feet above the water line, so that they cannot blend, as one light, unless at a considerable distance or in hazy weather: to prevent this, a blue light, of three minutes' duration, is burnt on board every two hours of darkness, according to the seasons; November to February, inclusive, commencing at 6 p.m.; March to October, at 8; May to August, at 10. The blue lights being elevated on a pole, can be seen in the horizon so soon as the mizen lantern rises to view, which is at ten miles distance. During a fog a bell is rung and a gong sounded alternately; and to give a chance of being 'peered-out' under a dense haze, the mizen lantern is lowered under the gunwale.—*Capt. Denham, 1840.*

pilot, and one will come off in a row-boat. This harbour must not be taken before half flood, and no vessel should attempt it at night if they can possibly keep off shore until daylight, unless very well acquainted.

2. ON TAKING the NORTH CHANNEL, and proceeding thence to TORY ISLAND.

If, after weathering the Hoyle Sands, the wind should be so far to the southward of West as to enable a vessel to weather the Isle of Man, it may be a matter of consideration whether it be most adviseable to go through the North or the South Channel; but this should not be hastily decided on. In the summer months the winds are more variable than in winter, and then it is certainly adviseable to choose that passage which is nearest to the destined port, giving the preference to the North Channel, if bound to British America, Newfoundland, or the northern ports of the United States. In winter, the prevalent winds are from S.W. and W.S.W., and these winds often blow steady for several days.

Should the North Channel be preferred, with southerly and S.S.W. to W.S.W. winds, (and it should not be attempted with any others that have westing in them, especially by a stranger,) it is adviseable to take a departure from the Lights on the Calf of Man, and steer a direct mid-channel course, with a careful look out, as the passage is narrow, and the tides very rapid, but running directly through the channel: the flood setting from the northward toward the Mull of Galloway. With a W.S.W. wind it will be necessary to keep the Irish shore aboard, after passing the two lights on the Maiden Rocks, or it is possible, in a strong gale from this quarter, that there may be some difficulty in weathering the Isle of Illa.

The North Channel is well lighted and has many excellent harbours, fit for the largest ships, as Lough Foyle, Belfast Lough, Loch Ryan, Campbelton, Lamlash, &c. but it is adviseable for vessels, if possible, to take those upon the Irish Coast, as they can get to sea with southerly and S.W. winds, when it may be difficult to get away from either Lamlash or Campbelton.

After passing Tory Island, do not be too anxious to make southing, but steer well to the westward, if possible; for there is always a very heavy sea and a strong indraught upon the West coast of Ireland, and strong westerly and W.N.W. gales are very prevalent in the winter. Although there are some excellent harbours in the N.W. of Ireland, they may be considered as inaccessible to a stranger, owing to the great difficulty of procuring a pilot in the winter season; every exertion should, therefore, be made to keep off this dangerous and too often fatal coast.

The depth of water or quality of the soundings in the North Channel, will give little or no indication of the progress of the vessel, so that a good look out is here the mariner's best safeguard; the coasts on both sides being bold, excepting about the South Rock and Maiden Rock, both of which dangers are well lighted, but require a good berth in passing, particularly the latter.

In running through the North Channel with S.W. winds, every stitch of canvas should be carried that the vessel will possibly bear, as these winds often fly suddenly round to the N.W. quarter, and in that case blow so hard, for 24 or 36 hours, as to compel a vessel either to bear up for the South Channel, take a harbour, or lie-to in a narrow and dangerous channel for a more favourable wind.

3. ON PROCEEDING by the SOUTH CHANNEL, and thence WESTWARD to the OCEAN.

If it be intended to persevere in working down the South Channel, it will be the best way to keep the Irish shore aboard by short tacks, should the weather be squally with heavy rain, as the vessel will then have the benefit of the N.W. wind and smoother water, should it fly round to that quarter, as is often the case. In dry or moderate weather, there is little fear of a sudden shift of wind; and a vessel, in such case, may make a long board toward the coast of Wales. Should it come on to blow from the S.W., with much rain, get the Irish coast on board as soon as possible, especially in the winter.

Vessels passing up or down the South Channel with westerly winds, will find a strong indraught setting into Caernarvon and Cardigan Bays, as well as into the Bristol Channel; and this may be probably, in some degree, accounted for by the following and perhaps other causes: southerly, S.W., and westerly, winds prevail over the Atlantic, between the Azores and Great Britain, during 8 or 9 months of the year, causing the surface current in this vast space to flow to the eastward; the tides in the neighbourhood of, and to some distance westward of Scilly run 9 hours out of the 12 to the northward or into St. George's Channel,

Channel, which, like the Strait of Gibraltar, has some resemblance in form to the pipe of a funnel, and it is probable that, in gales of wind from the S.W. quarter, there is very little, if any, ebb from the western edge of Channel soundings to a position 15 leagues West from Scilly, and thence to the northward, on the same meridian, until within 15 leagues of the South coast of Ireland: neither do I think it at all unlikely that a portion of the stream of 'Rennell's Current,' which frequently, as I shall hereafter show, runs with velocity to the N.W., may be diverted by westerly gales into a more northerly direction, and being opposed in its course by the South coast of Ireland, finds its way to the eastward, and thus contributes to raise the level of the water and make a strong tide or indraught into St. George's Channel.

This stream of tide sets E.N.E. toward the Tuskar, and nearly in the same direction, or a little more northerly, toward the Smalls, and rushes, with great velocity, past Skokham and Skomar, through the sound toward Saint David's Head, and along the South and East coasts of Cardigan Bay, from whence it diverges toward Bardsey Island; in the sound between which island and the main it runs with great strength.

It has been before stated that it is generally advisable to keep the Irish shore aboard in turning down St. George's Channel, with S.W. winds and heavy rain. In the South Channel the lead will impart some idea of the position of the vessel, or, at any rate, will indicate, by the depth of water, the probable distance of the vessel from the land. The banks on the Irish coast, between Howth Head and the Arklow Bank, may be safely approached to 20 fathoms of water, and nearer should it be clear weather, which, by the bye, is not often the case in this neighbourhood. When near the N.E. end of the Arklow Bank, and from thence to the westward, no vessel should shoalen her water under 28 fathoms without day-light and constant caution. The tides of both flood and ebb, run directly over these banks, in a N.N.E. and S.S.W. direction, and in light winds must be carefully attended to.

In beating to the westward, should a vessel shoalen her water on the coast of Wales to 30 fathoms, she will be quite far enough inshore, and should tack immediately, for it should be recollected that there are 36 and 40 fathoms very close to Bardsey.

Should a vessel be caught with hard N.W. gales, upon this dangerous coast, every exertion must be used by carrying taut well-set sail, to get the ship round the Bardsey, when she will have St. Tudwal's Road (which is well sheltered with westerly winds) under her lee, but a pilot can seldom be obtained here. The fixed light of Bardsey (*see page 10*) is open to seaward only when it bears from N.E. $\frac{1}{4}$ E. to E. $\frac{1}{4}$ S. Should N.W. winds continue blowing hard, it will be better to run for St. Tudwal's Road, on the North, or to Fisgard Bay, on the South, than to persevere too long in attempting to work out of Cardigan Bay.

Any moderate sized vessel may find good and safe anchorage in Fisgard Bay, by running in to two or three cables' length from the *Cow Rock*, on the west side of the entrance, and anchor when the land to the westward of it is shut in, and the rock bears N. by E., distant four cables' length. At this anchorage there is full 5 fathoms at low water, over a bottom of stiff clay and mud, which holds remarkably well, and the ship will lie well sheltered with all winds except those from north round by the eastward to S.E. by E. or S.S.E. N.E. winds throw in a heavy sea.

The coast in the vicinity of Fisgard Bay is clean and bold, and the Bay may be readily distinguished from the offing by the *Cow Rock*, which is always above water off the western point of the entrance, and by the remarkable appearance of Dinas Head (the eastern point), which, upon an easterly or S.E. bearing, exactly resembles the head of a large gurnet.

Were the advantages of Fisgard Bay more fully known, they would be duly appreciated. When the writer commanded the brig *Freeland*, of Liverpool, that vessel was disabled, by the loss of her sails, in the heavy N.W. gales which prevailed in December, 1833, and was obliged to run into this Bay in order to save the vessel from a lee-shore; and, in this place, she lay in safety, at single anchor, with 70 fathoms of chain, during the tremendous gales that caused the Liverpool light ship to part her moorings, and compelled her to run into the Mersey for shelter.

From what has been stated above, it will be seen that this Bay is of easy access and egress, but it should never be used unless in a case of necessity, and then with a good and careful look out at all times, and every thing should be in readiness to trip the anchor at the

the moment the wind veers to the eastward of north, if the weather be not very moderate and settled.

On weathering the Smalls, when outward bound, it is advisable to keep well to the westward if the wind will permit, so as, on advancing southward, to give Scilly a large berth,—say of 18 or 20 leagues.

4.—ON PROCEEDING by the SOUTH of IRELAND, from the OCEAN to LIVERPOOL, &c.

In coming from the Westward, many navigators endeavour to make Cape Clear, as it is high land, and has an excellent revolving light. The coast in the neighbourhood is also generally bold, but I do not think this is an advisable plan for a stranger, unless he has obtained good observations a very short time previously, for I have known vessels to be detained several days in endeavouring to work round the Cape against strong southerly gales and a N.W. current—unquestionably “*Rennell's*.”

In two of these cases, one in 1836, and the other in the present year (1839), two different ship-masters ran with confidence for Cape Clear, upon the faith of good observations for latitude, taken 48 hours previously, and both made the *Skelligs* on the starboard bow, when steering E. by S., with the wind from the southward and S.S.W., thick weather and rain. When the *Skelligs* were near, one of these gentlemen considered his vessel to be on the parallel of the Cape, and the other (in 1839), thought that he was at least 10 to 15 miles to the southward of it. It may be proper, however, to add that the latter denied the existence of Rennell's current, until he thus found the effect of it.

In thick hazy weather it may be well to run upon the parallel of 51° N., until the vessel gets into 65 fathoms or less water, then steer E. by N. or E.N.E. keeping the lead occasionally going, and be careful not to advance into less than 40 fathoms, when a channel course of E. by S. may be shaped, having constant recourse to the deep sea lead. By proceeding in this manner it is probable that the land will be made in the vicinity of Waterford, or about the Saltee Islands. Waterford may be known by its lighthouse on the Hook Point, on the east side of the entrance of the harbour.

A little to the westward of Waterford are the THREE towers, on Great Newton Head, and two towers, upon Brownston Head, as described in the Sailing Directory. The latter are about 6 miles to the westward of the Hook Point of Waterford, and are too remarkable to be mistaken. The Saltee Islets are 4½ leagues to the eastward of the Hook Point, known by its tower and fixed light. The *Great Saltee* is high, and may be readily known by the Coningbeg light ship, moored to the S.W. of it. No vessel should attempt to pass between the light vessel and the land if it can possibly be avoided, the passage between being rocky and dangerous.

The weather is often very thick on the Nymph Bank, with wind from the southward and N.W. quarter, and the Tuskar is, consequently, very difficult to make. The Smalls and Tuskar, on the opposite sides of the Channel, when seen in this thick weather, have often been mistaken for a large sloop with a peaked gaff-topsail set. No vessel should run with confidence up St. George's Channel, without previously seeing one or other of the lighthouses on these rocks, or the land in the vicinity, as the tides are hereabout very strong, and hidden dangers abound in the vicinity of both places, as shown by the charts. To the eastward of the Nymph Bank the weather generally becomes a little clearer than upon it.

The course may be safely altered when the Tuskar bears North, and an allowance of one point or more must be made for the direction of the wind; particularly if blowing from the N.W. quarter, as this wind not only increases the indraught into Cardigan and Caernarvon Bays, but it throws a heavy sea upon the whole line of the coast of Wales northward of St. David's Head.

In running from the “*Smalls*” toward Holyhead it is, at all times, advisable to steer a point or more to the *northward* of the direct course, unless there is easting in the wind; and should Holyhead or the South Stack lighthouse be made upon a bearing to the *northward* of N.E. by E. ½ E. the course should be altered a little, to bring it upon this bearing; otherwise the vessel may find some difficulty in weathering it upon an ebb tide, if the wind should come out from the N.W. quarter, as there is a strong set (along the land) to the southward into Caernarvon Bay.

The island or rock called the “*South Stack*,” distinguished by its lighthouse, is very bold, but, with light winds and a flood tide, strangers should give it a berth of 3 or 4 miles, as there is much danger of being set inside the Skerries, if this is not attended to. In light winds

winds and a flood tide steer well to the northward, until the Skerries bear E. by N., then gradually edge away to the eastward, until the lighthouse bears E. by S. distant two miles, when the flood-tide, with a very little assistance from the wind, will carry a vessel safely to the northward of it.

The Skerries may be approached by a stranger, on the north side, within a mile, and when the lighthouse bears S. by W. steer E. by N. two miles, and east one mile, or until the upper beacon on Carnel Point comes open to the eastward of the lower one, when the vessel will be clear to the eastward of the Coal Rock. On proceeding thence with a southerly wind, give a small berth to the "*Middle Mouse*," a large rock always above water, and very bold. On steering thence toward Point Lynas, take particular care not to shut up the light if it be in the night. Should the light happen to be shut up, instantly run to the northward or N.N.E. until it opens, and heave-to or stand off and on for a pilot, about 4 or 5 miles to the eastward of the light, or between it and the Great Ormes Head.

In thick weather, after passing the Skerries, great caution is requisite in order to avoid the Coal Rock, and keep clear of the ebb-tide running through the Sound; for, upon an ebb-tide, the land between Point Lynas and the Skerries must not be approached within 3 or 4 miles without a commanding and favourable breeze.

Vessels bound to Liverpool should make signal for a pilot immediately after passing the Skerries, as the pilots are very often well to the westward, and keep a diligent look-out; but should no boat be seen, cruise about for one, in the position before stated (between Lynas and the Ormes Head) as the tides here do not run strong; but do not, on any account, run a single mile to the eastward of the Great Ormes Head; for, should thick weather come on, the vessel will be in danger of being driven upon the West Hoyle or the Burbo banks, and lost. It sometimes, but rarely, happens when an unusual number of vessels come up on one tide, that there is no pilot boat on the Lynas station, but it will only be left for a few hours, and vessels should wait with patience, for *here* a pilot is *sure* to be obtained.

The Liverpool pilot boats are sloop rigged with a square-headed gaff-topsail, painted with a white bottom and black bulwarks, and have their number conspicuously painted on the foresail and mainsail. These boats have no topmast, but when upon their station carry a flag at the mast head. If in the night, fire guns occasionally, hoist a light, and show a torch composed of new rope yarns, unlaid and saturated with bright varnish, then marled slack upon a stick. This shows an excellent light, which may be seen at a great distance; it is also much better and more noticed than a blue light, from the latter being so frequently used as a signal of recognition by passing steam boats.

The Liverpool pilots are under very excellent regulations, are exceedingly skilful in their profession, and in point of character and conduct are not surpassed by any similar body of men on the coast of Great Britain.

Although I have before noticed the necessity of an unremitting attention to the lead in thick weather, perhaps I may be excused for adding here, that such attention is of the *greatest importance*; as, owing to the velocity of the tides, it affords the mariner the only certain indication of his safety or danger, and contributes to relieve his mind in some degree from the anxiety he must feel whilst his vessel continues within the limits of this dangerous navigation.

It may be well to notice that on and after the 1st of December, 1839, Marryat's Code of Signals will be in general use on the telegraph stations between Liverpool and Holyhead.

In *all* the channels leading INTO Liverpool, *red* buoys are to be kept on the *starboard*, and *black* buoys on the *larboard*, hand in going *into* the port; and *all* vessels must keep *inside* or *between* the buoys. In the *Victoria Channel* *all* the buoys are moored upon the edges of the various banks, which are all bold-to; and there is a black buoy moored opposite, and marked similar to every red one.

Of the four channels into Liverpool, the Victoria is the only one that can, at present, be recommended without a pilot. A vessel cannot lead up this channel with a wind to the southward of S.W. but with southerly winds a vessel can keep an offing.*

* The alterations in the marks for, and the channels to, Liverpool, since the year 1833, have been introduced into the charts, as described in the *Nautical Magazine*, October, 1839: other changes may be expected, from the nature of the sands, as shown in the '*Sailing Directions*' by Captain Denham, 1840.

SECTION III.

PARTICULAR DESCRIPTIONS of the COASTS of the ATLANTIC; with DIRECTIONS for SAILING among the ATLANTIC ISLES.

* * The BEARINGS and COURSES are those by COMPASS, unless where otherwise expressed : but those given thus [*W.S.W.*] signify the TRUE : and the given direction of Wind, Tide, and Current, is to be considered as the TRUE.

1. ENGLAND, FRANCE, SPAIN, and PORTUGAL.

THE Coasts of England and France have been accurately and minutely described in the New Sailing Directory for the English Channel, &c. It is not requisite, therefore, nor consistent with the limits of the present work, to repeat the descriptions given therein. But, as it is possible that a ship may be driven, by stress of weather, into the Bay of Biscay, we shall here introduce a few remarks on such of its harbours, or places of shelter, as may be resorted to, in case of emergency.

Of these harbours, the first, and probably the best, is that called DOVARNENEZ BAY, to the southward of Brest Harbour. This Bay is, in general, fair and clean, and its soundings are so even and regular, that no leading-mark is required. The upper part shoalens regularly to 8 and 6 fathoms, within half a mile of the beach, with fine oozy sand. A large fleet may lie here with as much safety as in Portsmouth Harbour, being almost land-locked at such distance from shore, that no shells can reach.

It is also to be observed that, a strong wind, which may detain shipping here, would also keep in all the Brest fleet ; and, with westerly winds, ships can turn out from this bay when none can move from Brest Harbour ; so that it has been a useful place for British ships of force, even during war.

A rock, called the *Basse Vielle*, uncovered at two-thirds ebb, lies at the distance of half a league W.S.W. [*S.W. $\frac{3}{4}$ S.*] from Point Chevre, the north point of the entrance ; and there are several sunken rocks off the south shore without the bay ; but between is a clear channel, $2\frac{1}{2}$ miles broad. In going in, you sail to the southward of the Basse Vielle, at about two miles from the south shore, and will thus have regular soundings, from 35 fathoms, rocky bottom, to 26, 24, and 22, fine sand, all the way till within the bay ; thence there are regular soundings to 10, 8, and 6, fathoms. The bottom on the north side is mostly fine sand, as is that in the upper part of the bay, but the former is best for anchorage.

A clump of trees, with a little chapel in the midst, stand on the north side to the eastward of Point Chevre, having a windmill to the westward, and two to the eastward. With the windmill next to the eastward of these trees just open with Chevre Point, you will have passed the Basse Vielle, and may steer for what part of the bay you please ; all being fair and clear, excepting what may be seen above water, and what may be near the shore. The general depths over the bay are from 18 to 12 fathoms ; and all, as before observed, is clean ground.

LIGHTHOUSES, &c.—The grand scheme of improvement, in illuminating the French coasts, which has long been in a state of progression, appears now to be, if not entirely, very nearly accomplished, under the guidance of men of the first rank in talent and ability. The lights of Ushant and other lighthouses have been improved, and new towers, of the several classes, have been established, as shown in our preceding pages (22 and 23.

Of the new lights, those of the *Sein* or *Saintes* and *Bec du Raz* must be eminently serviceable

viceable to ships advancing from the westward, to the northern part of the Bay, while that of Belle Isle and others are equally serviceable more to the south.*

Even on the Spanish shore, the new tower upon the eastern side of *San Sebastian*, and that on *Cape Mayor*, near Santander, as described in page 26, are highly important to vessels which may be driven, by stress of weather, toward this dangerous coast, as well as to the pilots.

BELLE ISLE.—This island, which is high, and seen from a great distance, may afford good shelter in a westerly gale. Its N.W. end is in lat. $47^{\circ} 23'$, and its S.E. point in lat. $47^{\circ} 16'$. The N.W. end of the island is surrounded with rocks, and nearly in a line between it and the Isle of Groix lies the rocky bank called the *Birvideaux*. If a ship, with the wind at N.W. or W.N.W. keeps between the latitudes above mentioned, when running for the island, on approaching it, she may steer along the south side, at the distance of two miles, to Point du Canon, the S.E. extremity. From off this point, haul up for Point Locmaria, the eastern point, which is situate about a league from the former. Under this point may be found anchorage in from 15 to 8 fathoms, sheltered from N.W. and westerly winds. Should the wind here veer to S.W., a ship may run to the northward of the point, and anchor on the N.E. side of the island.

The *Isle of Hedic*, (having a fixed light,) which lies about $7\frac{1}{2}$ miles East [*E.N.E.*] from the East end of Belle Isle, has many rocks, with foul ground about them. The range, called the *Cardinals*, extends to the S.E. from the island, and the extremity bears E.S.E. $\frac{1}{4}$ E. 12 miles from the S.E. end of Belle Isle. Should a ship be driven to the eastward of Belle Isle, she must give the Cardinals a good berth; then haul up to the northward for anchorage.

In the Bay of Quiberon, after you have brought the Cardinals to bear S.S.W., S. by W., or South, there is good anchoring, with clear soft clay ground, and very even soundings, in from 10 to 12 fathoms. With these bearings you will be shut within some foul ground, lying off to the Cardinals, in an extent of 3 miles in length, with the Cardinals from W. by S. to S.W., and which has destroyed the cables of several ships of war.

Excellent water may be obtained from the wells at the Isle of Hedic, with numerous refreshments; the inhabitants being extremely inoffensive, civil, and obliging. Shingle ballast and fine sand are also to be procured in abundance.

ROAD of BASQUE.—This road lies within the isles of Ré and Oleron, the north-western extremities of which are distinguished by the light-houses mentioned in page 23. In running for this place, the rocky banks, called the *Banches Vertes* and *Roche Bonne*, must be carefully avoided.†

The *Isle of Ré*, on its western side, is environed by shoals. Off its N.W. end are dangerous rocks, called the *Baleines* or *Whales*; and a rocky bank extends thence a league out to sea. The rocks on the S.W. side extend to the distance of half a league from shore; but they diminish thence to the S.E. end of the island.

Off the S.E. end of Ré, midway between it and the main-land, is a small rocky bank called the *Lavardin*, dry at low water, spring tide. It lies about a mile and a half S.E. by E. [*E. by S.*] from the S.E. end of the island.

Around the North end of Oleron is a shelf of rocks, called the *Antioche Rocks*, which extend 2 miles to the eastward of the lighthouse, but within which there is anchorage. On the Light-tower, called the *Tour de Chassiron*, is the fixed light, at 164 feet above the sea, as shown in page 23.

On sailing in, it is safest to keep over toward the Isle of Ré, until near the S.E. end of this island; only taking care to avoid the Lavardin, above-mentioned. Then steer for the

* The particular descriptions are given in our Sailing Directory for the Bay of Biscay, 3rd edition, 1839.

† The *Roche Bonne* is a dangerous shoal; being a great flat of rock, lying between the parallels of $46^{\circ} 10'$ and $46^{\circ} 15'$, at 12 leagues westward from the lighthouse on Baleine Point. The S.E. rock, of 18 feet water, lies in latitude $46^{\circ} 11' 25''$, and longitude $2^{\circ} 25'$. The plateau or flat extends N.W. $\frac{1}{2}$ W. to lat. $46^{\circ} 15'$, with a breadth of two to three miles. Not only on this flat is the swell of the sea to be apprehended, but also on several heads of rock, on which there may not be more than 10 feet at low water. The rocky bottom, situate to the N.N.W. of the Roche Bonne, known under the name of *Banche Verte*, is not dangerous. Westward of the rocks, in all their extent, the bottom is of mud. *Directory for the Bay of Biscay*, p. 24.

west part of the Isle of Aix, a flat island, with some houses on it, which lies about half way between Oleron and the main land. [*For its Lighthouse, see page 24.*] The road extends from the Lavardin Shoal to this little island, and has, from 10 fathoms close to the shoal, to 12 and 13 in the middle of the road; and from 5 to 9 fathoms at about a mile and a half to the North and N.W. of the Isle of Aix. There are 6 fathoms at half a league West from the island, and good ground.

The soundings in mid-channel, between the Isles of Ré and Oleron, are generally from 12 to 15 fathoms, shoaling toward each side. This channel is nearly 2 leagues in breadth. The French Man-of-war Road is on the South side of the Isle of Aix.

THE FOLLOWING DESCRIPTION of Basque Roads, &c. is from the pen of Captain W. H. Smyth, R.N., K.S.F., &c., by whom it has been most obligingly communicated.

Basque Road is a fine anchorage, at the confluence of the Charente River, with a good hard bottom, carrying from 8 to 20 fathoms at low water spring-tides. It is formed by the coasts of La Vendee and Charente to the North, East, and South, and to the westward by the islands of Oleron and Ré, on the extremities of which stand the Baleine and Chassiron Lighthouses. In sailing in, care must be taken to keep the mid-channel, in order to avoid the danger of Antioche and Grignon Shoals. The French shipping ride under the protection of the small but strongly fortified island of Aix.

ROCHEFORT, where the French fleet is equipped and constructed, is about 16 miles from Aix, and possesses very considerable and commodious arsenals. ROCHELLE has a capacious haven, surrounded by a prodigious mole, reported to be 5400 feet in length, but it has not depth of water for large vessels. It, however, answers the purpose, as the trade from hence, and, in fact, all the coast, is carried on, during war, in small convoys of chasse-marées, under the protection of gun-brigs, prames, &c., which coast along, generally, within range of their own batteries. Their principal cargoes consist in wine, brandy, sugar, salt, (of which abundance is made at Ré,) coarse cloth, and a few other commodities. OLERON once belonged to the English, and was rendered famous, during the crusades, by the construction of the first maritime code of all the European nations, generally known by the appellation of the *Laws of Oleron*, issued by Richard the First of England. This is a populous and fertile island, about 15 miles long and five broad; the number of its inhabitants is generally estimated at 12,000; the chief town is defended by several forts, and a strong castle.

THE GIRONDE AND NAVIGATION TO BORDEAUX.—The Lighthouses named the *Tour de Chassiron*, on the north end of Oleron, and the *Tour de Cordouan*, at the mouth of the Gironde, have been noticed in the present work, page 23, but their uses are more fully explained in our “Directory for the Bay of Biscay.” On the island of Oleron, as we are informed by Captain Livingston, there are seven windmills, very near each other. The shore is low, with sand-hills near it, and from the *Maumusson Passage*, at the south end of the island, to *Coubre Point*, at the mouth of the Gironde, is all sand with little hills or hummocks of the same, of no great height, the size and shape of which probably vary with every gale of wind.

After opening the land up the river, beyond the light-tower on Coubre Point, some spots covered with trees or bushes form a verdant contrast to the arid sand. One of these spots is only a short distance inland from the tower.

Terre Negre, on the north shore, is about seven miles to the south-eastward of Point Coubre. At one place, near this, the bottom of the river is of flat rock, so that no anchor will hold. At that place, *M. Pontjuet*, a pilot, said there was 18 fathoms of water, and a little below only 15. Here were such ripples and overfalls that I should have been very much alarmed if no pilot had been on board.

On the opposite side of the North Channel is the *Bank of Montreviel*. The steeple of St. Palais just on with a small wood, which is sufficiently remarkable, is the leading mark or *enfilade* for the shoalest part of this bank, which is by far the most dangerous of any in the vicinity. It has spots of very little water, and both ebb and flood set directly on it. By the lead it appears to consist of sand; but *M. Beaupré*, on his late survey, pierced the sand with a lance, to which a weight of 200 lb. was attached, and found rock above 4 feet under the north part of its surface.

The sail up from Royan to Bordeaux is delightful; the scenery on the left or eastern bank is particularly fine. At one place a great deal of a fine white soft freestone is quarried, not as with us, out of open quarries, but out of caves, and when they cease working

working a cave, poor people take possession of it, build a neat front like a cottage to it, carry a long chimney stalk up the side of the rock, and externally they appear very comfortable: of the interior we can say nothing, but they really have a very picturesque appearance.

The Semaphore Tower on Point de Grave is now converted into a Lighthouse, and exhibits an excellent fixed light. There is also a small light at Royan, merely intended for the use of the pilots.

The CURRENT generally sets N.N.W. off the Mouth of the Gironde; and, with southerly winds, it is scarcely possible for one of the pilot boats, which sail and will lie near the wind, (being rigged with two lug sails,) to beat up to the river from Oleron; and it is always advisable to make the Cordouan tower, or rather to proceed even more to the southward, than directly to make Coubre Point; the shoal from which breaks very heavily, for a long way out, in bad weather.

The BASSIN d'ARCACHON is briefly described in the Sailing Directory, page 26. Of this place *M. Pontjuet*, the pilot, says, he has been in with his boat: the north channel is widest, but the southern one has most water; indeed, he says, 14 feet; but it is so extremely narrow that it is impossible to tack, and a vessel must have the wind aft and keep close along by the south shore, almost rubbing her sides with the sand. There are plenty of fine sweet but small oysters there. When you are once in, the appearance of the Basin is beautiful.—*Letter of Capt. Livingston, Aug. 1828.*

BAYONNE.—The little harbour of Bayonne may, in time of peace, afford shelter to small vessels, which are towed in by stout boats under certain regulations.* The land in the vicinity is low and level, excepting some little downs, covered with pines and other trees, which are rather more elevated than the rest.

The river Adour passes through Bayonne. Its entrance lies between two level sandy hillocks. At times the broken water extends a mile out from the mouth of the river, and the boats cannot get out. For the accommodation of vessels entering, in this case, there is a square pyramidal tower, having a flagstaff on its top, situated on a small sandy hillock, on the S.W. bank of the river, about a mile from its mouth, and various signals are made, as shown in the Book of Directions. The Bar should not be approached by a stranger nearer than just sufficient to distinguish the signals. These indicate whether a vessel may venture in or must stand off. A vessel which, from tempestuous weather, may not be able to force the Bar, should, if the wind permit, put into the port of *Passage*, in Spain, whence a coasting pilot will be sent, with instructions to conduct her to Bayonne.

It is strongly recommended to captains bound to Bayonne, particularly in winter and with westerly winds, to make the land on the coast of Spain, between Cape Machichaco and San Sebastian; that, in case the weather should become tempestuous, and crossing the bar of Bayonne dangerous, they may have to leeward of them either the ports of San Sebastian and Passage in Spain, or St. Jean de Luz and Socoa in France, from which ports they will be sure of obtaining pilots.

Within the piers of Bayonne you are out of danger, and may anchor where most convenient, in $4\frac{1}{2}$ or 5 fathoms, a depth which continues up to the town. The latter is handsome, at about a league from the sea. There are said to be only 3 or 4 feet over the bar at low water.

The *Revolving Light of Biarritz*, on *Point St. Martin*, (noticed in page 23,) is exceedingly useful as a guide to the Adour or River of Bayonne.

COAST of SPAIN.—Off the north coast of Spain, which is high, bold, and rocky, the depth of water, in general, is from 150 to 200 fathoms, foul ground and coral; but, in many places, there is no ground at that depth, even near the shore. The principal harbours on this coast are those of *Bilbao* and *Santander*; yet both of these are devious and shoal.

BILBAO.—Of the Bay of Bilbao a particular plan is given on the New Chart of the Bay of Biscay. Its entrance, which is three miles wide, is formed by the points, named Luzuero and Galea. The greater part of its coast is lofty, steep, and rocky; but the bottom of the Bay, on the eastern side, is low and sandy.

The mouth of the river Bilbao is impeded by a shifting bar, having less than one fathom

* See the New Directory for the Bay of Biscay, already noticed.

over it at low water. Here are two piers or kays, within which is the town of PORTU-GALETE, and off which is the best anchorage in the harbour. Spring tides rise about 13 feet. In winter a heavy sea sets into the Bay, which, at times, renders it impossible for the pilots to go off.

If coming in, when the tide does not serve for taking the bar, with an unfavourable wind, you may come-to in the Bay, midway between the outer points Luzuero and Galea; bring the latter in a line with Cape Villano, in 16 fathoms, with sandy bottom. There is here sufficient room, in case a heavy on-shore wind should bring home the anchor or part the cable, to let go a second anchor, before the ship can get ashore. In summer, you may lie nearer to the land, in from 10 to 12 fathoms, all the bottom being of sand.

On making the bay from the westward, POINT GALEA, on the eastern side, may be readily known by its white colour. Should you pass Santona, the bay may be thence distinguished by three sharp-pointed mountains: of these, the northernmost is that of LUZUERO, the middle one and highest, the hill of SERANTES, on the west side of the bay. The southern one appears like an island. On steering for the first, you will, of course, make Point Luzuero.

SANTANDER.—Of this harbour, also, a particular plan is given on the New Chart of the Bay of Biscay. Cape Mayor, or the Great Cape, on the western side of its entrance, lies in latitude $43^{\circ} 30' 10''$, longitude, $3^{\circ} 40'$. This cape is of moderate elevation, but steep, and distinguished by its lighthouse. Cape Menor, or Little Cape, half a mile more to the S.E., has a battery on it. This is lower than Cape Mayor, and terminates in a low flat point, with a small reef of rocks below it.

On the same side, at the distance of one mile and three-tenths to the south-eastward of Cape Menor, is Point Puerto. The land between forms the sandy BAY of SARDINERO, in which vessels anchor when the wind and tide do not serve for going into the harbour. The best anchorage here is with the Capes Menor and Mayor in one; and, at three cables' length from the former, you will find from 10 to 12 fathoms; bottom of sand: but more to the southward, it is all of rock or stone.

The extensive sands on the south side of the harbour frequently shift, and a great portion of them is dry at low water. On the north side, from Point Puerto eastward, the coast is rocky, and defended by several batteries. The town has a small pier.

With the wind blowing fresh, from the S.W. or N.W. quarters, it is impossible to take the harbour of Santander: but vessels may, with flood-tide, occasionally bring up in the Road of the Promontory, which is clean and roomy, and there wait for a wind. With an ebb-tide, it will be better to come-to in the outer bay, off the beach of Sardinero, as already described.

An islet, named *Mouro*, which is high and steep, lies in the entrance, at half a mile N.E. from Puerto Point; close to its eastern side is a large rock, and there is a shoal at a cable's length to the N.W. of it; otherwise there is deep water around it, and the channels on each side are clear and good.

Although Santander has been considered as the best harbour on the north coast of Spain, eastward of Cape Ortegal, there is little doubt that it is now filling up, and that the channel and even the anchorage now used may, in a few years, become impracticable.

CAPE ORTEGAL, Cape Prior, with the other headlands in the vicinity, are high and steep. The ground without generally rocky and foul. At the foot of Cape Ortegal are 9 or 10 sharp-pointed rocks above water, with 15 or 16 fathoms close to them; and there is a rocky shoal at half a mile N. by E. [*N. by W.*] from the cape. A watch-tower on the highest land, at a mile and two-thirds from the cape to the southward, is a good mark for distinguishing it from sea-ward. Hence to Cedeira the land is steep and rugged, but to the northward of Cape Prior it falls into sandy bays. At different distances from shore are many scattered rocks, on which the sea breaks in a swell.

Both the stream of tide and current of the sea set in toward the land of this coast; so that the utmost attention is requisite, in order to avoid being embayed with light winds. With a good steady breeze, large ships may, however, pass safely within two miles of Cape Ortegal.

FERROL.—From Cape Prior to the harbour of Ferrol, the land is highly mountainous, with large rocks, above water, along shore. The Bay, forming the entrance of Ferrol Harbour, is only a mile wide, and the channel from it into the harbour but 2 cables' length

length in its narrowest part. There is, nevertheless, sufficient depth in mid-channel for large ships, at all times of the tide, viz. 8 to 10 and 12 fathoms. When within, you keep over to the north side, where you may haul up, and anchor in from 4 to 6 fathoms, sheltered from all winds.

CORUNNA, &c.—The north part of the peninsula of Corunna is distinguished by the remarkable lighthouse, called the *Tower of Hercules*, constructed with three sides, and exhibiting a revolving light, as shown in page 26. On the coast, without the elevation on which the lighthouse stands, there is a bank of rocks extending N.W. to a considerable distance. But, from the meridian of the lighthouse, a ship may range along the coast into the harbour, to the S.E. and South, and find anchorage with the town bearing S.W. in 14 and 15 fathoms.*

GENERAL REMARKS ON COMING IN WITH THE COAST ABOUT FERROL AND CORUNNA, from the Spanish of TOFINO.—“During the night, ships should never advance too near to the land; for not only does, at times, a powerful current set in for the land from the N.W.,† but the streams of flood and ebb often draw vessels out of their computed situation, especially in winter, or in thick foggy weather, which is frequent here. In the day-time, the sandy beach at the bottom of the hills may often be seen, when the latter are obscured in mist and haze. Ships from the westward, which cannot take the harbours in the day, should not advance to the eastward of the meridian of Cape St. Adrian, or about Cisargas Isle, (8 deg. 44 min.) where they should stand off and on, according to the state of the wind; for lying-to may be dangerous.

“During south-westerly winds, the currents set, with great strength, between Cisargas Isle and Cape Ortegal; and vessels have often been carried thus to leeward of the harbour of Ferrol, where there is no place of shelter or safety. With north-easterly winds, a ship should run within two miles of Cape Prior, and thence steer for Cape Priorino, in order, if the wind be not very strong, to gain the anchorage in the Bay of Carino; or, to stand away, if it be so, for Corunna.

“In the neighbourhood of Cisargas Isle and Cape Prior, as well as off the intermediate points, it is necessary, in hazy weather, to sound frequently; for the soundings will be a monition before the roaring of the sea on the shore can be heard.”

From CAPE ST. ADRIAN, the high land continues to the Bay of Camarinas, with rocks above and under water. CAPE VILLANO is of rock, not very high, but perpendicular toward the sea. Within it at a short distance, is a sharp peak, of a red colour, which, at a distance, appears like a tower. At the distance of a cable and a half, N.N.W. from the cape, is the *Rock of Bufardo*, steep-to, and over which the sea breaks.

CAPE TORIANA, which is three leagues to the S.W. by W. [*S.W. by S.*] from Cape Villano, makes a sharp and steep projection into the sea; it is not very high, and when seen from between N.E. and S.W., resembles the awning of a galley. At a distance it is not always distinguishable from the high land at the back of it. At two cables' length west from the point of the cape, is a small sunken rock, which breaks with a little swell.

The NAVÉ of FINISTERRE, a high mountain so named, stands at the distance of five miles and two-thirds to the S.S.W. [*South*] from Cape Toriana. Its summit is flat; and, at about one-third of its height from the sea, there appears to be a short point with hummocks on it, and having at its base a small but high island. In the bay formed between Cape Toriana and the Navé of Finisterre, vessels may safely anchor during north-easterly and easterly winds, off a fresh-water rivulet, in from 6 to 8 fathoms, sandy bottom, but not in deeper water, as there the bottom is rocky. Care must also be taken not to advance too near the north shore, as it, also, is foul.

CAPE FINISTERRE is only half a league South from the Navé. It may be readily known from sea; because there is a bight between it and the Navé, with low beach, and the land behind less elevated. As there are no other points like these on the neighbouring coast, they cannot easily be mistaken.

PORTUGAL.—THE COAST OF PORTUGAL is variegated with rocky promi-

* See the Charts of the Bay of Biscay and the Coasts of Spain and Portugal, with the Harbours, on enlarged scales, lately published by Mr. Laurie.

† See Explanation of the Currents, pages 155, 159, 163, 164, and 169.

nences falling away into low sandy bays. Its harbours universally require the aid of pilots. Such are Viana, Oporto, Aveiro, and even Lisbon. The latter has, however, a good channel, with 6 fathoms over the bar at low water, yet it should not be attempted by a stranger, lest the winds fall calm, and the strength of the current set him on the banks. Here the powerful operation of the tides has caused the destruction of many ships. Off the city the ebb runs down at the rate of seven knots, and the danger in entering is when a strong ebb is running down, opposed to a strong wind from sea, which makes a complete break, sometimes all over the Bar. Under these circumstances a vessel is almost unmanageable, and the tide may sheer her about; but, in the middle of the Great or South Channel, the tide sets directly through. To enter the river, during the ebb, would require a brisk gale and all sails set, in order to make any way, or even to stem the current; and, it is to be observed that, within the river, the wind comes very irregularly through the valleys on each side, unless it proceeds from the West or S.W. It is, however, tolerably steady when in the direction of the river. (See further the new 'Directory for Spain and Portugal,' pages 14, 15.)*

CAPE ST. VINCENT.—"Soundings extend to a considerable distance from Cape St. Vincent. To the southward of the cape fishing boats may frequently be seen at anchor, fishing about 8 miles off shore.

"Off the Cape, to the westward, the surf, by beating on the precipitous and cavernous rocks, may sometimes be heard to a surprising distance."—*A. L.*

LAGOS.†—According to the latest observations of ☉ and ☿ and ♃ ♄ ♀ ♁ Lagos is in latitude 37° 8' 40" North, and longitude 8° 37' 45" West, which differs a few seconds from the position generally adopted, and which appears in the Tables of the scientific; but, from a number of coincidences, I should prefer this in a final determination. This place, and Villa Nueva, in time of war with Spain, are of the utmost value and import, more particularly if there is a blockade of Cadiz, as ships are despatched there to water; on which occasion it is necessary to observe the following instructions. At half-flood the boats can get near enough to land the casks, and may be taken off as late as quarter-ebb. The tide ebbs and flows in Lagos River at two o'clock, full and change: it rises about 13½ feet in the spring, and 9 in the neaps. The bar is just covered at low water. It has 14 feet on it at high water spring tides, and 10 feet at the neaps. In fine weather, about 180 tons of water may be rafted off in twenty-four hours. Refreshments, such as poultry, pigs, fruit, rabbits, pigeons, vegetables, &c., are to be procured reasonably.

VILLA-NUEVA.—In Villa-Nueva River, water may be got in transports, at about 150 butts in twenty-four hours; which must be rafted three or four miles down the river with the ebb tide, as the water is too shoal for ships to go nearer the fountain where it is procured. There is a depth of sixteen or eighteen feet of water on the bar; but, in my opinion, it is only a summer watering place; as the Portuguese told me, that, in winter, the bar is seldom passable for ships, as the breakers are very dangerous, and the swell a long way outside it. At the lower watering-place a butt may be filled in eight minutes, and in seven at the upper. A great quantity of salt is shipped at Villa-Nueva.

TRAFALGAR.—Cape Trafalgar, by the antients called the *Promontory of Juno*, is about fifteen or sixteen miles to the eastward of Cadiz, and twenty-three or twenty-four miles to the southward of it; its appearance is flat, and distinguished by a white building. Those unacquainted with the navigation between this and Cape St. Mary, generally labour under great dread of a gale of wind from the S.W., and, from want of knowing how these gales come on, frequently get into difficulties. The S.W. gales generally commence with the wind at S. by W. or S.S.W., and continue blowing on these points five or six hours, although the sea sets in from the westward; and it is too common for persons, unaccustomed to navigate in this bight, to have their minds impressed with the danger of the shoals lying off Point Regla, commonly called the shoals of San Lucar, and falsely represented as very alarming. Under this apprehension they are induced to haul their *starboard tacks* on board, and push for the Strait of Gibraltar; whereas the real danger lies at the entrance of

* On the 4th of November, 1839, a notice was given to the chairman of Lloyd's by order of the Lords of the Committee of Privy Council for Trade, that the government of Portugal now require the masters of all foreign vessels, entering the ports of that kingdom and its dominions, to bring their manifestos in duplicate.—Signed, *Denis le Marchant*.

† The descriptions of Lagos, Villa Nova, Trafalgar, and Tangier, have been communicated by Captain W. H. Smyth, R.N., K.S.F., &c.

this Strait, and consists of dangerous reefs of rocks, with uncertain soundings, in no wise to be depended on. Between Cape Trafalgar and Tarifa, (and when you suppose yourself round them, and the Straits open,) in thick weather, not able to see land on either side, you will feel yourself in a very awkward situation to find out the drift of the ship, or ascertain whether you are in a fair way to push through the Gut; which you will be compelled to do, should the gale continue, and you are within the influence of the stream; for you can (as before observed) gain no information by the lead of the reef of rocks, which lie W. by N. of the island of Tarifa, and are extremely dangerous. On the other hand, by standing to the westward, with the *larboard tacks* on board, at the commencement of a S.W. gale, when the wind is from the southward, for instance, at S.W. by S., and you make four points leeway, you will make a fetch to the westward of Ayamonte; or even with a N.W. course made good, you will weather the bar of Huelba, and the lead will inform you the distance the ship is off the land, fifteen fathoms being the very shoalest part you should stand into along the north shore.

The outer shoal of San Lucar is not at a greater distance than $2\frac{1}{2}$ miles N.N.W. [*N.W.*] from Point Regla; the ground, outside the shoal, is even and hard, with ten fathoms of water close to it; about half a mile to the northward of it there is a spot with eight fathoms. No allowance is made for a S.E. current, which always prevails when out of soundings, and even in sixty fathoms.

A more particular description of the land, between Cape St. Mary and Cadiz, may be found in the Sailing Directory. *Cape Trafalgar*, the last great promontory of this coast, may be known by its remarkable figure, being flat, and terminating with two sharp corners or angles. A round tower stands on the east corner; to the eastward of the flat, the land is very uneven and mountainous. To the east of the flat land are high sandy cliffs, but none to the westward.



E. $\frac{1}{2}$ N. Cape Trafalgar, with the pitch and tower E. $\frac{3}{4}$ S about 3 leagues. E. $\frac{3}{4}$ S.

It is to be noted that the southern side of the reefs called the *Cabezos*, lies $5\frac{1}{2}$ miles, W.N.W. [*West*] from the light tower of Tarifa. This appears to be the spot on which the British frigate *Thisbe* touched, in August, 1804; the depth over which was estimated at 14 feet.

2. THE COASTS OF AFRICA, from TANGIER to CAPE MESURADO.

TANGIER.—This place is of importance to the navigator, both in peace and war, on account of the refreshments to be procured, which are almost the only traffic the Moors have. The principal articles are cattle, sheep, pigs, poultry, eggs, fruit, and vegetables, of which a limited quantity is allowed to be purchased by each ship.

The bay affords convenient anchorage for vessels of all sizes opposite to the town, in from 8 to 10 fathoms, sand; but it is to be observed that, on the eastern side, there is a rocky ledge, bearing S.E. by E. $\frac{1}{4}$ E. from Tangier Point, and S.W. by W. $\frac{1}{2}$ W. from *Cape Malabat*. This cape, in a line with Europa Point, Gibraltar, leads clear of the shoal; and the anchorage, therefore, lies with Gibraltar open of the cape. Ships moor to the N.W. and S.E. with the longest cable to the N.W.; and it is proper to buoy up and protect the cables, as they may be exposed to injury from the hard roots of large sea-weeds, which grow in the bottom of the bay, as well as from coral, &c.*

Tangier is described by *Captain Washington*† as situate on a deep acclivity, rising at once from the beach, and presenting its eastern and not displeasing aspect to a bay about three miles wide. It is surrounded by mouldering walls, round and square towers every

* It is to be observed that the proper anchorage is in the centre of the Bay. On the west of this anchorage is, or lately was, a large old mooring chain, supposed to have been laid down in the reign of Charles II. king of England, and found to extend nearly in an East and West direction, and in a line with the north side of the town of Tangier; its West end being at nearly a mile from the nearest shore. Tangier Point is altogether surrounded by foul ground, to a considerable distance.

† See Note 2, page 31.

sixty paces, and three strong gates. Its defences toward the sea are two batteries, one above the other, on the south side of the sea-gate. Directly in front of the landing place, high on the wall, are about 12 guns; to the north, in a circular battery commanding the bay, about 20 guns of all calibres, mounted on clumsy Moorish carriages, which would not stand fire for ten minutes; crowning all, to the north, is an old and extensive castle, *L'Kassbah*, and the residence of the governor. On the land side, ruined walls and a ditch are the only defences. The gates are shut at sun-set, and a watch is kept by night.

All persons who visit this place should pay implicit obedience to the advice of the Consul, as to the conduct to be observed during their intercourse with the natives.

In rounding *Cape Malabat*, some years since, at the distance of more than three-quarters of a mile from shore, the *Excellent*, of 74 guns, touched upon a rock previously unknown; at which time, from the starboard chains, were found $5\frac{1}{2}$ fathoms, and 6 from the larboard. Cape Malabat then bore S. by E. $\frac{1}{2}$ E., and the ship floated off in less than a minute. This rock is now known by the name of the *Almirante*, and described as having over its shoalest part 3 fathoms of water. There is also a sunken rock at nearly the same distance from Tangier Point, discovered by the *Pacifico* schooner, in 1818, and which lies with the inner coast of Tangier S. by W. [*S. by E.*]

In all the extent between *Cape Spartel* and *Cape Cantin* (lat. $32^{\circ} 35'$), as shown on the Chart, there are regular soundings toward the shore. In this tract there are no harbours of consequence; those which exist being nearly choked up with sand. On sailing along, the inland mountains may be seen at a great distance, covered with snow, even in April and May.

CAPE SPARTEL, the N.W. point of the state of Morocco, is situate in latitude $35^{\circ} 47' 40''$, and longitude $5^{\circ} 54' 40''$ W. The Cape, at a distance, appears like an island, and is so high as to be seen, in clear weather, at the distance of 14 or 15 leagues. The outer point, when seen from a short distance westward, appears uneven, with eminences on it like hummocks, and the high lands resemble the awning of a galley. The ground about the Cape is quite clear with the exception of some high rocks, steep-to.

Around the west side, and at about one-third of the whole height, from the summit, is a range of well-defined basaltic columns, appearing like a coronet. At the distance of two miles from shore are 98 fathoms, the bank immediately dropping to an unfathomable depth. To the southward of the Cape the bank extends much farther off, and there is excellent anchorage on a bottom of mud and sand, and shelter from easterly winds.

The following descriptions of the coast between the parallels of 36° and 28° (those of Cape Spartel and Cape Juba,) we owe principally to the survey of Lieutenants W. Arlett, in the *Ætna*, and H. Kellett, in the *Raven*, 1835-6; and to the notices of Mr. T. J. Evans, of H.M.S. *Dido*, 1837-8.*

From *Cape Spartel* the direction of the coast is S.W. 20 miles to *Arzilla*, a small fortified town situate close to the shore, between which and Cape Spartel there is good anchorage all along with an easterly wind. The depths of water are regular, 10 to 15 fathoms, over a sandy bottom, at one to two miles off shore. The coast-line is a flat, sandy, and shingly beach, rising to a fine grasing country in the interior.

The *Roadstead of Jeremia*, the usual anchorage near Cape Spartel, extends from it 8 or 10 miles to the S.W. The *Dido* anchored in the following positions in smooth water, and well sheltered from a strong Levanter, or easterly wind.

1st.—In 15 fathoms, sand and small shells, Cape Spartel bearing N.E. $\frac{1}{2}$ N.; the town of *Arzilla* S. by W. $\frac{3}{4}$ W.; extremity of land to the right, two points nearly in a line, S.W. by S. Distance to the nearest shore, about a mile and a half; soundings very regular to a depth of 5 fathoms, at two cables' length from shore.

2nd.—In 13 fathoms, coral rock, gravel and sand, Cape Spartel bearing N.E. $\frac{3}{4}$ N.; centre of the town of *Arzilla* S. $\frac{1}{4}$ E.; two bold and prominent points to the S.W. of the town, nearly in a line S.S.W. $\frac{1}{2}$ W.

At the village of *Almadronis*, nearly midway between Cape Spartel and *Arzilla*, landing can be effected. A boat of the *Dido*, sounding in this vicinity, landed, and numerous

* The first of these was given in the *Journal of the R. Geogr. Society*, Vol. VI., 1836, and the second in the *Nautical Magazine* of June, 1839. We have, of course, incorporated such other information as would render the description complete. See Notes on the Table of Positions, p. 32.

herds of cattle were seen grasing in the vicinity; but, on two officers and two seamen, part of the boat's crew, walking not more than a hundred yards from the beach, in hopes of procuring stock, they were immediately seized by a party of Moors; three were detained and conveyed into the country, the fourth having effected his escape. The Moors were armed, and were savage in their behaviour until they had made their prisoners. The ship, then lying at her first anchorage, was soon under way, and ran down off Arzilla, demanding from the governor the officer and men detained. A party of Moorish horsemen were now sent to scour the country, who found them on their road to Tangier, under a guard: on this they were escorted back to Arzilla, but were refused to be delivered up until permission was granted by the governor of Tangier. The delays were so protracted that the ship anchored off the town, to make a serious demonstration, in $4\frac{1}{2}$ fathoms water, at about 600 yards from the shore, and 150 yards outside a reef of rocks awash, which describe a semi-circle without the beach line, affording good shelter under its lee, with the principal fortress bearing S. $\frac{1}{2}$ W.

"The fortifications, which apparently are fast crumbling to decay, cover the whole sea face of the town, on which we observed mounted about 20 guns, of various calibres; in our position not more than 13 guns bore on us, and if we had anchored about half a cable farther north, not more than ten could have been used with effect. However, the garrison being deficient in ammunition, and defenceless on other points, the ship resumed her former anchorage, having gradual soundings, in all directions, from the reef of rock to a depth of 15 fathoms.

"The next day we received our people by permission of the authorities of Tangier, and started from their inhospitable shore. It is here necessary to state that, while prisoners they had been well treated.

"To account for the foregoing proceedings, it appears, by a treaty, that trading is forbidden at any port on the Moorish coast at which there is not a British consul, or his agent. At Arzilla there is a Spanish Jew in the latter capacity, who behaved uncommonly well on this occasion. Now, as we landed only five miles from an authorized port, it appears that they carried this article of the treaty to its fullest extent. In fact, it is generally attended with fatal consequences for a Frank, on an unauthorized part, on any pretence, whether from distress or a want of knowledge of their customs. An instance of a barbarous murder, committed on an Englishman who (in ignorance) had landed for the amusement of collecting shells on the sea-beach, and actually in sight of the ship, occurred a few years back, not three miles from where our party were seized; and it may be considered fortunate that this affair ended without loss of life. As a proof of the general ignorance of this custom, we had on board at the time of the above incident, five merchant captains, who had been in the habit of trading to the S.W. ports of Morocco, and who knew not that landing was against the laws; and it is to be regretted that our consuls in Morocco should not have given more general information on so serious a point."

Four or five miles to the N.E. of Arzilla is the *Wed el Ayasha*, a small river, barred across the entrance, but reported to flow sufficiently strong for a good supply of water; and the distance to roll the casks, the boat being anchored clear of the surf, not above 50 yards. The preceding description shows how far caution may be required.

Twelve miles inland from Arzilla is the *Jibel Habib*, a range of mountains very conspicuous from the sea, the loftiest of which is 3170 feet high above the sea. *Jibel Hasan*, another peak in this range, more to the northward, is 2270 feet high. Just to the north of the town of Arzilla is a castle in ruins, and date trees, which overtop the walls, are growing in the court. On the wall fronting the sea, which is strengthened by three towers, 20 guns are mounted. Under the southern angle of the wall is a well whitewashed tomb. The country around is well wooded, and a quantity laid out in gardens. The population is supposed not to exceed 600.*

From Arzilla the coast trends S.W. $\frac{1}{2}$ W., and at the distance of four miles the coast hills rise to the height of 734 feet; at five miles farther is the *Haffa el Beida*, a remarkable white cliff, in the shape of a wedge, which rises to 308 feet above the sea, and presents the same

* In the latitude of Arzilla the bank extends twelve miles from the land. Here is a mackerel fishery, on which 20 or 30 Spanish and Portuguese feluccas are employed. The method of taking the fish is by three hooks fastened together: the fisherman throws a handful of salt or sand into the water, to which the fish rise, and are immediately jigged with great dexterity. They are cleaned and salted on the spot.

form in all directions. It may be distinguished when five leagues off; but the best mark for the coast is the Peak of Fas, an insulated mountain, resembling a sugar-loaf, which stands S. by E. $\frac{1}{2}$ E. [S.E. 5° S.] from off the entrance of El Araiche, next described.

El Araiche, a picturesque ruin, is situate on the steep southern point of the river *al Khos*, which here meanders through a rich and fertile valley. *Al Khos* signifies *the bow*; *el Araiche*, the pleasure garden; but the people are barbarous, and the country is in an uncultivated state. The population of El Araiche is about 2500; and a little trade is carried on between this town and Gibraltar. Supplies are abundant, and there is a fine spring of water on the northern shore, very convenient for shipping.

The best anchorage is with the town between the South and S.S.E. The mouth of the river, which appears very broad, is really very narrow at low water, and has then only 5 and 6 feet water over it, but there is a rise and fall of 9 to 12 feet. Inside the water deepens to 24 feet. A 'pap,' or rising spot, on the north side of the river, is 204 feet high above the sea. The best anchorage in the roads for vessels intending to enter the river is with the distant conical mountain Fas, appearing in the centre of the entrance, one mile from the point, in 12 fathoms, sand.

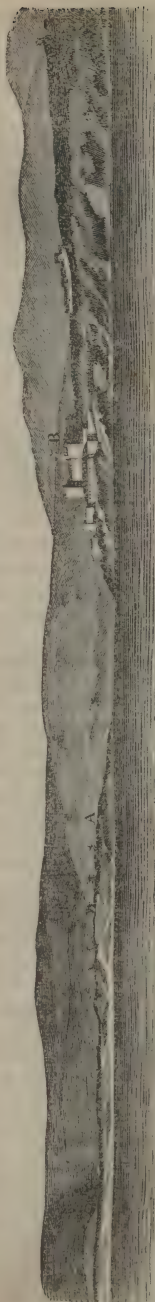
Between *Arzilla* and *El Araiche*, the ground is tolerably clean, but not very good, being coarse gravel, with 25 and 30 fathoms of water, at from one to three miles from shore. Before *El Araiche* the depth decreases, and there are only 4 fathoms at 2 cables' length from shore. In sailing along this coast, care must be taken not to advance too near, unless it should be with a strong easterly wind; for sometimes, in calm weather, there is here a heavy swell from the West or N.W., which would render it difficult to get off shore.

The site of *Old Mamora*, known by several white-washed tombs, the chief of which is that of *Muley Bu Selham*, at the outlet of a stream said to flow from a small lake, 20 miles to the southward of *El Araiche*. At two cables' length from the Bar is a depth of 5 fathoms, gradually increasing to 34 at two miles from shore. The coast between *El Araiche* and this spot is straight, and for the most part about 300 feet in height; reddish cliffs for the first ten miles, then sandhills partly covered with brushwood. There are every where from 20 to 25 fathoms of water, at half a league from shore, and you may anchor off the coast hence to *Slaa* or *Salée*. Ships, in fact, must sometimes anchor here, during a calm, to avoid being drifted by the currents, which set to the southward, along the coast; and the velocity of which, especially at the full and change of the moon, is frequently from one to two miles an hour.

The Peak of Fas, above-mentioned, serves as a mark for *Old Mamora*, from which it bears nearly true East.

From this place the coast extends 10 leagues S.S.W. to *Mehedia*. The coast is very clear, a little higher than the former, and readily known, being of white sand as far as about the middle of its declivity, while the upper part appears like cliffs. The river *Sebou*, on the south bank of which the town is situate, is impassable, except in boats, or on rafts, at some distance from the sea, although navigable near the ocean. The town extends from the sea-shore to the top of the highest land, so that you may readily distinguish, from the offing, the walls of an old castle, situate in the upper part of it. Ships may anchor, at half a league from shore, in 12 or 14 fathoms, sandy ground: but, when the wind blows from the offing, and sometimes in fair weather, the swell is here very great, as well as along the coast. The best anchorage is with the town from S.E. by E. to S.E. by S.

Mehedia was formerly a place of some consequence, and is noted for the ruins of fountains, arches, &c. The town now contains only 300 to 400 inhabitants, chiefly fishermen, who subsist by the sale of *shebel*, an excellent fish, much like salmon, which is caught here in great abundance.



B. The Town.

A. The Port.

View of El Araiche.

In the summer, the wind generally prevails from N. by E. to N.E. along the coast. During winter, there is a blustering S.W. and S.S.W. wind; and, in this season, when it begins to chop about to the South or S.E., shipping must get off, for then it commonly shifts to the S.W. and W.S.W., with foul weather. When it changes to W.N.W. or N.W., the weather is likely to be clear.

Between Mehedia and Slaa, or Salee, the coast is rather low, with double land, very even, with a white sandy strand, therefore readily known. At about half-way the strand rises, and thence, southward, the shore consists of black and steep rugged rocks, with small hills.

SLAA and **RABAT**.—The towns of **SLAA** and **RABAT** are divided by the river called the *Bu Regreb*. In this river, between the two towns, some sloops of war, belonging to the Moorish sovereign, were formerly laid up for the winter. But Mr. Jackson has said that, going thence to Mogodor, a few years since, the vessel in which he was, of about 150 tons burthen, struck three times on the bar: and, as the sand continues to accumulate, it is likely that, in another century, there will be a separation from the ocean at ebb-tide.*

SLAA or **SALLEE**, says Captain Washington, once the terror of the seas, so renowned for its rovers, whose daring exploits reached even to our own coasts; whose city and port were a constant scene of riot, and bustle, and activity;—now ruined, still, and lifeless. The present town, built on a sandy point, extending to the sea, forming the north-eastern bank of the river, is about half a mile in length by a quarter in breadth, surrounded by walls 30 feet high, and square towers every fifty paces. Its defences, a long battery of 20 guns, facing the sea, a round fort at the entrance of the river, and a gun or two on the gates. The mosques, arches, and fountains, in the city show traces of beautiful sculpture, and of great antiquity. Streets narrow, and houses sombre, like all Moorish towns. Population about 10,000, of which 500 may be Jews, with apparently little or no occupation.

The river, called *Bu Regreb*, is here about 500 yards broad, when full. The Bar, about one-eighth of a mile from the entrance, extends almost across in a W.S.W. direction, with 3 or 4 feet on it at low water, leaving a channel at each end; the Moors use the eastern. Rise of tide, 9 or 10 feet. From the anchorage off shore the water shoalens very gradually till close to the Bar, where it suddenly drops from 7 to 2 fathoms. Here is almost invariably a heavy surf.

RABAT, on the S.W. side of the river, is 50 or 60 feet above its level, on banks of crumbling sand-stone. It is crowned by a venerable and battlemented *Kassbah* or citadel. A curtain of 500 yards, facing the sea, flanked by two circular batteries of 12 guns each, about as many more in the *Kassbah*, and a small battery overlooking the river at the S.W. end of the town, form its sea-defences. The town is three-quarters of a mile long, by one-third in breadth, and walled orchards of about 200 acres reach along the banks of the river.

The old *Kassbah* was built in the twelfth century, and some subterraneous magazines in it, remarkable for their strength, being bomb-proof, are still preserved; there are, also, the remains of a small battery, which defended the entrance of the river. At a short distance South of the castle, on an elevated situation, is a square fort, the walls of which are about 2 miles in circuit, and strengthened by square towers; they enclose the castle, the town of Rabat, and a large space of ground, where stand a palace, and the mausoleum of the shareef or emperor Sidi or Seedy Mohammed.

A remarkable old tower at Rabat, called the *Tower of Beni Hassan*, is the best sea-mark for this place. It is built of hewn stone, is 180 feet in height, 35 or 36 feet broad.† At a small distance to the northward of it, are the ruins of an antient wall, on which were formerly a battery and castle.

The country in the neighbourhood is planted with vines, oranges, and cotton, of an excellent quality. There are docks for ship-building, both at Salee and Rabat.

The tower above-mentioned is described by Captain Washington as that of *Smā Hassan*, and as the most conspicuous object, standing 220 feet above the level of the river, and the

* See Mr. Jackson's Description of Morocco, &c.

† A particular description of this tower, &c., is given by M. Cassini, in his Voyage to Newfoundland and Salee, 1768.

first by which this coast would be recognized in approaching from sea, as it must be visible from the deck of a frigate 6 or 7 leagues. He adds, the main street of the town, which runs parallel to the river, contains the principal shops; not very attractive; the markets abundantly supplied with vegetables and fruit; orange orchards, vineyards, and cotton plantations, are extensive: the fruits excellent, though grown on a light sandy soil. Moorish population, about 18,000; Jews, 3000. The Jewesses the prettiest in the empire. There are ten mosques, besides the mausoleum of the sultan above mentioned, and that of the Moorish hero *Al Mansor*.

The road of *Slaa* is dangerous for shipping, and the accumulation of sand at the entrance will scarcely permit a vessel of 100 tons to enter the river without danger. Vessels may lie in safety out of the river, near *Rabat*, from April to September inclusive; but they are not secure in the rest of the year, the wind blowing from the southern quarter, and often obliging them to quit their moorings. The best anchorage in this season is between the mosque of *Rabat* and the old tower of *Hassan*, keeping the former to the northward. As a great number of anchors have been lost in the road, much attention must be paid to the cables. The positions of *Slaa* and *Rabat* may be seen in the Table, page 27.

EL MANSORIA, shown on the Chart, is a square of 150 paces, enclosing an Arab village. The tower of the mosque, 80 feet high, stands 180 feet above the sea, from which it is less than a mile distant. From the deck of a frigate it may be visible at six leagues. The coast here is iron-bound and rocky.

FIDALLAH or *FEDALA*, a peninsula, frequently mistaken for an island, forms a harbour, having a depth of 5 or 6 fathoms, which affords shelter to small vessels during westerly winds. A roadstead here is supposed to be the only one, with the exception of *Agadeer*, in the parallel of $30^{\circ} 27'$, wherein ships on the coast may ride in security during winter. This is owing to a projection of the land, South of the peninsula above-mentioned.

The village of *Fidallah*, situate at three-quarters of a mile from the sea, is a walled square, of about 200 paces, enclosing a respectable mosque, the ruins of European merchants' houses, and an Arab encampment. It may, perhaps, contain 300 inhabitants, Moors, Arabs, and Jews.

Between *Rabat* and *Point Fidallah* there is no danger beyond a quarter of a mile from shore; the Bank of Soundings extends to the distance of 20 or 22 miles from the land, increasing south-westward. From 160 fathoms, mud, the water shoalens suddenly to 90 or 80 fathoms, between which depths and 60 fathoms it continues for many miles, sand and mud, decreasing to 30 fathoms at three miles from shore. The inland features vary slightly; two lines of barren and gently undulating hills, from 200 to 300 feet in height, extend nearly parallel to the coast; the more distant are from four to six miles from the sea, the nearer not more than a mile, sloping gradually to the beach, which is generally sandy, with occasional patches of rock.

DAR EL BEIDA.—At four leagues W. by S. from *Fidallah*, is *Dar el Beida*, a small walled town on the beach, within a point projecting half a mile N.N.E. true, and forming a cove, three-quarters of a mile deep, and well sheltered from westerly winds. This town, as well as *Fidallah*, was built for the exportation of corn. The towers of three mosques are conspicuous, and one is of superior height. Around the town are many palm-trees and gardens: water in abundance. Inhabitants about 700, including Jews, among whom is a British consular agent.

This place is easily known by its towers, one of which seems almost as high as *Hassan's* Tower at *Salee*. The coast between is low, and bordered with small islets, all very near the land.

There is a reef of rocks at one-third of a mile off the town, and the landing place is behind them. Some other parts of the bottom are likewise rocky, and in winter the anchorage is unsafe, owing to the current, &c. From the cape rocks extend to the distance of nearly half a mile, and farther off is a rocky bank of 6 fathoms. At 20 miles to the West is a depth of 150 fathoms, dark sand, decreasing rapidly toward the land to 45 fathoms at 12 miles from shore, and then gradually to the beach.

AZAMOR.—On a sand hill at about 13 leagues to the south-westward of *Dar-el-Beida* is the small town of *Azamor*, situate on the south side of the mouth of a river called by Mr. Jackson the *Morbeya*, and by Captain Washington *Wad-oom-er-begh*.* Its walls,

* Or *Um' er' beigh*; 'Mother of Herbage.'

crumbling to ruin, are tenanted by storks. The place is dull and lifeless; streets narrow and dirty; but provisions, fish, vegetables, and fruit, abundant and good. The population about 1000, including Jews. These carry on a considerable trade in wool, which is shipped from Mazagan. The inhabitants of the country around, who are of superior stature, are chiefly pastoral, possessing large flocks of sheep and goats, and mostly live in tents. Wood is scarce and dear.

The Bar of the river is dry at low water. The entrance is dangerous, and the shore flat, having not above 8 or 10 fathoms of water for a league or a league and a half from shore, and foul rocky ground, so that it is not safe to anchor hereabout.

MAZAGAN.—From Azamor to the remains of the town of Mazagan, on the S.W., the distance is 10 miles. This place is on a low rocky point, projecting to the north, which forms the western limit of a sandy cove, of about a mile and a half, and affording a good roadstead for small vessels. It is defended by several redoubts, enjoys a little commerce, excellent water, and good supplies. A large proportion of the buildings are used as store-houses for wool, of which great quantities are hence exported. There is a tank, admirably constructed, which will contain several thousand tons of water. A lofty building 140 feet high, now in ruins, appears to have been a lighthouse. There is anchorage off the coast, at a league from the shore, in 15 fathoms, clear sandy ground; but at the west point of Mazagan is a ledge of rocks, which stretch to the N.E. [N.N.E.] about a league into the sea, and are uncovered at low water. The shore hence, toward Cape Blanco North, is every where rocky and dangerous, to a considerable distance from it; and ships that stop here must anchor at two leagues off, in 35 or 36 fathoms of water, oazy ground: the swell is almost always very great, and the currents very strong. From Mazagan to Cape Blanco, the distance is 4 leagues. The shore between is merely a ridge of sand hills. About midway are the ruins of *Tett*, an antient town, and a conspicuous tower, 128 feet high and 148 above the sea, which may therefore be seen from a great distance. Two large tombs, kept whitewashed, stand on either side of it.

The coast hereabout should not be approached nearer than a mile and a half, as scattered rocks lie off the shore, and the bottom is very uneven. The beach, in some places sandy, is generally lined with craggy rocks. A line of barren hills, 200 feet high, slope to the beach along the whole distance, and terminate just to the northward of the cape in a low and dark but abrupt and rocky cliff.

CAPE BLANCO NORTH.—This is in latitude $33^{\circ} 8'$, a little to the southward of the headland last mentioned. It is 170 feet high, appears to be of white sand-stone, and the lines of strata, white and red, rising parallel to the horizon for some distance, suddenly drop at nearly a right angle to the water, and the cliff appears like a wall. In a bight on the S.W., which is formed by the cape, is a good anchoring place, of sufficient extent for several ships.

At 22 miles westward of Cape Blanco are soundings of 150 fathoms, fine sand, gradually decreasing to 28 fathoms at four miles from the shore.

A dark and rather projecting cliff, formerly represented as an islet, under the name of *Duksal*, stands at about four miles southward from Cape Blanco; and, at six miles from the cape hills rise gradually from the beach to the height of 465 feet, the greatest elevation on the western shore of Morocco. Hereabout are the ruins of *Woladia*, where it seems there was once a harbour. At four and seven miles to the southward of these, on the edge of the cliff, are those of two other small towns, supposed to be Eder and Teturia.

CAPE CANTIN, &c. *Ras al Hudik*,* or CAPE CANTIN, in latitude $32^{\circ} 32\frac{1}{2}'$, is a steep headland, which rises precipitously to 211 feet above the sea, and has a ledge of rocks projecting from it; on its summit is a small sepulchre. At 16 miles westward from the cape are soundings of 100 fathoms, fine sand; this depth gradually decreases eastward.

From the preceding description it will appear that, between Cape Blanco and Cape North, the coast is much higher than the coast between Cape Blanco and El Araiche. It trends to the S.W. by W. $\frac{1}{2}$ W. [S.W. $\frac{1}{2}$ S.] $12\frac{1}{2}$ leagues, and is safe all along, having only some small islets very near the land. At two leagues off the depths are 40 and 50 fathoms, oazy ground. The currents are very strong, and generally run in the direction of the coast, S.W. by S.

* *Ras al Hudik*—Cape of Palm Groves.

From *Cape Cantin* to the North point of *ASFEE* or *SAFFI BAY* the coast trends S.S.W. [*nearly South*] four leagues, and is much higher than the coast already described. Between these points, at the distance of a league from shore, is a rocky bank, extending North and South, *true*, having over it from 30 to 40 fathoms, and, at times, abounding with fish. From the North point of the bay (which is foul) to the town of *Asfee*, or *Saffi*, the distance to the S.S.E. is $2\frac{1}{2}$ leagues.

The North cape of the Bay of *Saffi* forms two headlands; on the southern one is a tomb or sanctuary. The coast between *Cape Cantin* and the bay is one continued white cliff, with a sandy beach at its base: the cliff, rising gradually to its southern projection, is there 530 feet in height, and here the bay commences. In the bight within is a ravine, the bed of a winter torrent; and on the slope stands the antient town of *Saffi*, in lat. $32^{\circ} 18'$ or $32^{\circ} 19'$, between two hills, which render it intolerably hot; and, in winter, very disagreeable, as the waters from the neighbouring mountains, occasioned by the rains, discharge themselves through the main street into the sea. The road is safe in summer; but, in winter, when the wind is from South or S.W., vessels are frequently obliged to make off to sea.

Saffi is a considerable town, surrounded by a wall 31 feet high, with a ditch, and defended by 24 heavy guns next the sea. The tower of one mosque is 209 feet high above the surface. Fresh water is scarce, and procured from wells southward of the town. The country in the immediate vicinity appears sandy and barren; but the interior abounds in corn, and two falls of rain in a year are said to be sufficient to bring it to maturity. The population of the town, which has gradually decreased, is now supposed not to exceed 9000 persons.

During the summer months, or from March to October, the bay affords as good anchorage and smoother water than any other on the coast, but is entirely exposed to westerly winds; the bottom is of sand and mud, and there is generally a depth of about 15 fathoms at a mile from shore. Vessels may anchor at a league from the town, in 20 or 22 fathoms of water, gray and oazy sand. To anchor in the Road, the North point, on which stands a low tower, must be brought a little to the northward of N.N.E. Or, farther in the bay, the same point may be brought North (by compass) a little easterly, when the northernmost of two northern points will appear about a ship's length open, without the southernmost; and the high castle of the town S.E. by E. or S.E.; the depths 16 to 18 fathoms, fine gray sand. There is also anchorage within, in 15 fathoms, with the North Point N.N.W. or N. by W.; but these are the summer roads: in the winter, you must anchor farther from the land, in 20 or 22 fathoms, as already shown. You may boldly run in to the summer roads by night, with the castle bearing E. by S. or East.

If bound to *Saffi*, from the northward, shape such a course as will lead sufficiently to the westward of *Cape Cantin*, in order to avoid the rocks about that cape. You may easily know on which side of *Saffi* you are standing, as the land to the northward of the bay is high and uneven, and that to the southward of it is a plain even land.

From the south point of *Saffi Bay*, which is very low, to the mouth of the *Wad Tansift*, or River of Morocco, the coast trends S.S.W. $\frac{3}{4}$ W., [*S. $\frac{3}{4}$ W.*] 16 miles, and presents, generally, a line of sand-hills, from 150 to 200 feet high, which, in some places, terminate in low cliffs, and in others slope to the beach. Inland is a ridge of sandy looking hills, covered with brushwood, the highest 650 feet above the sea. There is a large tank on shore, nearly midway between *Saffi* and the *Tansift*, and on the southern bank of the river is an old castellated building, square and roofless, which was built for the use of travellers. The bar of the *Tansift*, although a considerable river, is in summer entirely dry at low water.

MOGODOR.—From the *Tansift* the coast extends in the direction of S.W. by W. $\frac{1}{2}$ W. [*S. 40° W.*] to a low sandy point, forming a cove to the northward of it, with rocks within half a mile from the beach. The coast which, from the *Tansift* is barren and uncultivated, and from 200 to 300 feet in height, here assumes features of fertility. The lofty *Jibel Hadid* or *Iron Mountains*, extending more than 20 miles, is a mass of high land, which here rises to the height of 2350 feet; another nearer the sea, with a conspicuous tomb on its summit, rises to 2100 feet.

A sandy beach continues from the reef point nearly S.W. [*S. 21° W.*] 12 miles, to *Mogodor*: the inland prospect is here bounded by the *Botof* sand-hills, which extend parallel to the beach, at the distance of a mile.

SUERRAH or **SUIRA**, otherwise *Mogodor*, is the only port on this coast which maintains

tains a regular commercial intercourse with Europe. Its population has been computed at 9500 persons. This town is built on a low flat desert of accumulating sand, which separates it from the cultivated country, and is defended from the encroachment of the sea by rocks, which extend from the northern to the southern gate; though, at spring-tides, it is almost surrounded by water. There are two towns, or rather a citadel and an outer town. Those Jews who are not foreign merchants, are obliged to reside in the latter, which is walled in, and protected by batteries and cannon, as well as the citadel.

The wind being high all the summer, with little intermission, nothing grows here in sufficient quantity to supply the inhabitants; all kinds of fruits and vegetables are therefore brought from gardens 4 to 12 miles distant; and the cattle and poultry are also brought from the other side of the sandy hills, where the country, although interspersed with *Harushe*, or stony spots, is capable of producing every necessary of life. The insulated situation of the town, and other circumstances, deprive the inhabitants of all resource, excepting that of commerce, so that every individual of the place is supported directly or indirectly by it. In this respect, it differs from every other port of the coast.

An Island which lies to the S.W. of the town, forms the harbour. This island is about $1\frac{1}{2}$ mile in circumference; and between it and the main land, on the South, is the anchorage.* There are here, in some parts, only 12 feet at low water; therefore, large ships do not enter the port, but anchor at about $1\frac{1}{2}$ mile westward of the Skalla, or long battery, which extends along the west side of the town toward the sea.

On approaching the land in the parallel of Mogodor the first remarkable feature which appears is the craggy summit of Mount Atlas, covered with snow, and contrasting with the dark ridge of hills between it and the coast. To the northward, the *Jibel Hadid* appear insulated, and, as you draw nearer, a long patch of sand becomes visible; and finally the white towers of Mogodor rise, as it were from the water. Soundings in 100 fathoms may be found at 23 miles from shore, when the water immediately becomes discoloured: the soundings decrease very gradually over a bottom of sand.

Mogodor has a beautiful appearance, at a distance from the sea; the houses being all of stone, and white. The streets are, nevertheless, narrow and dull. A winter seldom passes but some ships are driven a-shore by the S.W. winds; and this happens generally between the 8th of December and the 18th of January, the season called *Liali* by the Arabs, and the only period dangerous for shipping in the bay.

Lieut. Arlett says that, of the inhabitants of Mogodor, in 1835, 4000 were Jews, separated by a wall from the quarter of the Moors, whose portion is called the *Citadel*. All laborious work is performed by Jews, and domestic servants are all of that class. Much of the trade is also monopolized by the same people; for owing to certain exemptions from duty, they are enabled to undersell European traders.

The principal exports are wool, gum, wax, hides, skins, almonds, honey, ostrich feathers, and gold dust. Imports,—iron, hardwares, and cotton goods. Duties fixed and not very heavy. The want of water has been diminished by the construction of an aqueduct which conveys the stream from the river, a mile and a half distant, to several large tanks in different parts of the town. One of these is exceedingly convenient for vessels watering, being close to a jetty, inside a fortified bridge, which connects an islet with the main: here boats may fill, toward high water, perfectly sheltered from all winds. The market is excellent; provisions of all sorts, including fish, poultry, and game, are abundant and cheap, as are, also, fruit and vegetables.

The position of the British consul's house, as given by *Lieut. Arlett*, is $31^{\circ} 30' 29''$ N. and $9^{\circ} 47' 38''$ W. Capt. Boteler, as shown in page 27, makes the longitude $9^{\circ} 44'$. From the roof of this house the highest snowy peak of Atlas is seen, bearing S. 45° E.†

The roadstead, during the winter, can scarcely be considered tenable; and even in the summer the strong N.E. winds which prevail cause a very disagreeable sea. A westerly wind throws a very heavy swell into the harbour; but, notwithstanding reports which prevail to the contrary, it is not generally unsafe for vessels properly found in cables and anchors.

* See the Survey of the Bay and Town, by Sir W. Sidney Smith, on the Chart of the Coasts from Gibraltar to Cape Blanco, published by Mr. Laurie.

† See Captain Washington's note upon this particular, in the 'Journal of the Royal Geographical Society,' Vol. VI, p. 291.

The North Passage into the Harbour is between the town and island. A great ledge of rocks extends from the main, among which those next to the island stand high above water. In coming from the northward, if you would sail in behind the island, you must run between it and those rocks, close by them, where you will have 5 fathoms of water. The best anchorage is under the island, in $2\frac{1}{2}$ fathoms, as there the ground is good.

South Passage.—A small reef extends from the South end of the island, toward the main land; and, on the South side of the passage, a bank extends from the main land to a considerable distance. In sailing outward, run along by the latter, and you will soon be in 4, and thence to 10, fathoms of water. The tide flows here, on the full and change, at 4h. and rises from 10 to 12 feet. The current is scarcely perceptible.

Mr. JUDAH PADDOCK, in the Narrative of his wreck and captivity, in the year 1800, which is more particularly noticed hereafter, has made some useful remarks on the port of Mogodor; and he says, that the regulation of the police, with respect to the market there, is a matter worthy of notice. Every morning an officer goes to each stall, and pastes up a piece of paper, upon which is written what is to be the price of beef for that day. So severe is this regulation, that no seller dares to exceed that fixed price; though every one is at liberty to sell as much below it as he pleases. Thus much trouble is saved, and no imposition can be practised on the buyer, as the meat is rarely sold below the fixed price. The price of the meat is governed by the price of cattle, which are constantly for sale without the gates, and are always cheap.

The exportation of horses was utterly forbidden; but mules, asses, and horned cattle, were permitted to be exported, after payment of a specific duty, similar to that laid on the other productions of the country.

“THE IMPOST was under a peculiar regulation, very agreeable to the mercantile houses, which was this; when a ship arrived, a report of her cargo was made: there were no custom-house forms, no bonds entered into for the Emperor’s dues, but the goods were all landed, and put into his stores. One-tenth was then taken by the Emperor’s officers, and the remainder was given up to the merchant, who took it away at pleasure. Articles, however, that were not used by the Mooselmin, such as ardent spirits, wine, &c., were subject to a particular duty, which, being paid, those articles, like the rest, were suffered to be taken away from the Royal stores. The merchants in Mogodor had but very little trouble in making this division between the government and themselves; for their correspondents, if made acquainted with this resolution, would, in shipping goods, have them packed in *tenths*; for instance, ten pieces in every package of cloth, so that when the goods were all stored, it would require little time or trouble to divide them according to law. Smuggling was very rare. The guards at the city gate were so diligent, that any clandestine management could readily be detected.

“Duties on exports were paid at the city gates in the following manner: A merchant intending to ship a quantity of goods, goats’ skins, for instance, informs the governor of his intention, and requests him to be at the gate on a given time of the next day. The governor attends in person, accompanied by a scribe, and a servant following with a mat for him to sit on. He looks at the bundles and counts them, points out a few which he orders to be opened and counted, and on being satisfied as to the number of skins in each, the scribe calculates the sum that he should receive as government dues. On his demand, it is counted out to him by the merchant, who previously knew the exact amount. The scribe counts again, and informs the governor if it be correct, who then gives permission to ship the articles, and returns with the scribe and his servant. I frequently thought, while I was in Mogodor, that, of all the parts I had visited, none was nearly equal to this for doing business, relating to imports and exports, with ease and correctness.”

At the distance of about two miles inland from Mogodor is the *Commerce Garden*, an agreeable place of resort for the European residents and strangers, and which has the advantage of a fresh-water rivulet running through it. This place, Mr. Paddock says, was presented to the merchants of Mogodor by one of the emperors (shareefs), and it contained, besides vegetables, some trees and shrubs affording a little fruit. “The deariness of the neighbouring country made this little spot delightful. There was a house in it, which, though a small one, was sufficiently large to accommodate a large party, who commonly met about noon to partake of a cold dinner, and returned home toward evening. From what I discovered among my friends, these convivial assemblies were productive of some good. The English and French were then at war, but the subjects of both these great nations joined in these parties in the garden, as well as other convivial meetings; and during the nine weeks that

that I frequented this mixed company, I never heard one political subject discussed. Consul *Gevin* told me, that each party showed the same desire, in company, to avoid every observation on the subject of home concerns, which related to the contentions between the two governments."

FROM MOGODOR southward.—At $8\frac{1}{2}$ miles S.W. from Mogodor lies *Ras Tagrifelt* or *Cape Sem*, a low sandy point, sloping gradually from the height of 490 feet, and terminating in a reef of rocks which extend, on all sides, to the distance of rather more than two-thirds of a mile. The coast between this and Mogodor is a continuous line of bare sand-hills, 70 feet high, and sloping to the beach. In the back ground are the *Botof* sand hills, covered with a dark evergreen. Under the cape is said to be a rocky bank, stretching two leagues off, and upon which, at a league from shore, has been found 13 fathoms; at two leagues, 20 fathoms, rocky ground; at 3 or 4 leagues, 35 and 40 fathoms, oazy sand. Hereabout the current sets violently to the southward.

CAPE TEFELNEH.—CAPE TEFELNEH, at $18\frac{1}{2}$ miles S.S.W. from Cape Sem, rises to the height of 780 feet, and terminates in a point from which a ledge of rocks extends half a mile, with deep water close to them. There is anchoring ground under it, on the South, affording shelter from East and N.E. winds, in 10 fathoms, sand. At 8 miles to the northward of Cape Tefelneh is *Kuleihat*, a small village on the side of a wooded hill. A little stream, *Tidsi*, falls into the sea at its foot, through a picturesque ravine: between these high cliffs, apparently of sand-stone, face the sea.

CAPE GHIR or GEER (properly *Ras Aferni*) is situate, according to Lieut. Arlett, in lat. $30^{\circ} 37' 30''$, and longitude $9^{\circ} 52' 30''$, and projects boldly into the sea at 25 miles to the southward from Cape Tefelneh. The intermediate back land rises to the height of 2895 feet above the sea: the country appears wooded, and numerous villages and tombs may be seen. On approaching Cape Ghir from the westward it presents a bold bluff slope on each side, the highest part 1235 feet above the sea. The depths of water gradually diminish, and soundings are found at 26 miles off. The coast between Cape Tefelneh and Cape Ghir is a sandy beach. *Cape Ghir* is very remarkable, and may be seen when 4 leagues off. To the northward of the cape, about 4 miles within land, stands a round hummock, which is a mark for the cape, and the land farther to the northward is still higher; but on approaching the cape no land will be seen to the southward of it. From the North side of the cape, a reef extends to some distance out to sea, and should not be approached nearer than in 20 fathoms of water.

AGADIER or SANTA CRUZ.—The town of *Agadier*, or *Santa Cruz*, stands at six leagues south-eastward of Cape Ghir, at the bottom of the bay of the same name. This is the last port of Marocco on the Atlantic Ocean. The town, which stands on the summit of a mountain, is strong by nature, and its walls are defended by batteries; but the principal battery is at a short distance from the town, down the mountain, and was originally intended to protect a fine spring of fresh water, close to the sea. This battery also commands the approach to the town, both from the North and South, and the shipping in the bay. The ruins of the town, called by the Portuguese *Fonté*, remain at the foot of the mountain; and the arms of that nation are yet to be seen in a building erected over the spring.

The bay is considered as the best road for vessels on the coast of Marocco, being large and well-sheltered. It abounds in fish, immense quantities of which are caught by the inhabitants of the town, and prepared in ovens for transportation to the interior. Owing to the jealousy of its government, Agadier has ceased to be a place of trade; yet it was formerly the centre of a very extensive commerce, whither the Arabs, and the people of Soudan, resorted to purchase merchandize, for the markets of the interior of Africa; and caravans were constantly passing to and from Tembuctoo.

From the northward high barren hills slope to the beach, which is rocky, to the distance of five miles N.W. of Agadier, where a streamlet, the *Wad Tamarect*, flowing through a green valley, discharges itself into the sea. The high land, extending from Cape Ghir to Agadier, usually called the *Heights of Idautenau*, is the western extremity of the main chain of the Atlas, which ranges hence in an E.N.E. direction, and rises at nine miles to the eastward of Agadier, to the height of 4408 feet, and a remarkable conical hill, 3980 feet.

At 6 or 7 miles to the N.W. of Agadier, above a point stretching into the bay, is a good anchoring place, with from 20 to 12 fathoms. In sailing from the Cape to the road, be

sure to run along by the land of the cape till you are before the castle, because northerly winds are very prevalent here; and should you keep too far from shore, you may be forced to fetch it up again with difficulty. If coming in by night, approach no nearer than in 12 or 14 fathoms.

To anchor in the *Road of Agadier*, enter the bay so far that the castle may bear N.N.E., and the storehouses E.N.E. Here you will be to the southward of a rocky ledge, lying off the town, in 7 or 8 fathoms of water. The best riding is with Cape Ghir bearing North, in 6 or 7 fathoms. Care must be taken to have your anchors ready; your small bower is always to be laid out before the land-wind, and the others to seaward; the sheet-anchor must also be in readiness, and brought out to the S.W. against a storm, which is soon perceived by the rising and swelling of the sea. It is likewise necessary to keep the foresail to the yard, that you may defend yourself the better, should you happen to be driven from your anchors.

On the COAST of SUSE, southward of Agadier, there is no port frequented by shipping; but Mr. Jackson has emphatically stated that, "there is a tract of coast which holds out great encouragement to commercial enterprise, and secure establishments might be effected upon it, which would amply remunerate the enterprising speculator. The people of Suse are, also, well disposed toward Europeans, particularly the English; and the communication and short distance between this place and the provinces, or districts, where most of the valuable products of Barbary are raised, render it peculiarly adapted to trade."

From Agadier southward, the authority of Marocco lessens, and the Wedinoons proudly boast their independence.

Immediately to the southward of Agadier a very low and flat country commences, and extends thence 29 miles. At five miles to the southward of Agadier is the mouth of the *Suse*, a fine river, rising at the base of the Atlas; but the bar is dry at low water, and can never be passed by vessels drawing more than 4 or 5 feet. From the *Suse* the coast southward continues sandy. The *Wad Messa*, about 30 miles from the *Suse* has, likewise, a bar dry at low water, but may have 4 or 5 feet over it at high water spring-tides. At a short distance within this, on the north side is a village, and near the beach, on the south, a castellated building.

At a few miles to the northward of the *Messa* are the wells called *Tomie* or the Seven Wells, off which is an open roadstead. On this parallel, about $30^{\circ} 0'$, is a depth of 86 fathoms, dark sand, at 16 miles from shore, and 45 fathoms, sand and mud, at five miles from the same, decreasing thence gradually to the beach.

Cape Aguluh of the charts is only a slight rounding of the coast in latitude $29^{\circ} 49'$, long. $9^{\circ} 48'.$ * From the *Messa* southward the beach still continues sandy, but verdant hills, approaching the sea, break off into cliffs apparently of sand-stone, about 100 feet in height. In the interior is a ridge of high mountains, at 50 or 60 miles from the coast. The interval between appears like a wooded and well cultivated country, with many houses and farm buildings. Immediately to the southward of the cape is a little sandy bay, and a valley crossed by a hill on which stands the village of *Aguluh*. A small stream runs down the valley. The slopes of the hills were waving with corn, nearly ripe, in May 1835.

At 12 miles to the southward of *Aguluh*, the features of the country change; the hills become barren and abrupt, and form in successive ridges, gradually increasing in height till they join the line of distant mountains, which rise to the height of nearly 4000 feet, and appear to be the S.W. extremity of an off-set of the Atlas. More to the southward the appearance of the inland country continues the same, but the coast changes to dark red cliffs, broken into coves, on the beaches of which boats may be seen; and there are many villages, but inhabited by people of perfidious character.

In latitude $29^{\circ} 22'$ is a remarkable white cliff, supposed to be of limestone, and described by Lieut. Arlett as follows. Its strata are extremely curved and irregular, and it forms a good mark for the coast: behind it, and standing alone, is a conical shaped mountain, rising to the height of 3906 feet. In this latitude, at 25 miles from shore, are soundings in 105 fathoms, broken shells: outside of this the bank drops very suddenly. On standing in

* Where the *Messa* has commonly been represented. The latter, we presume, is in latitude $29^{\circ} 56'$, or thereabout,—Ed.

shore the soundings decrease rapidly to 60 fathoms. At five miles from shore are 28 fathoms, coarse sand; the depth thence decreases very gradually to the beach. From the cliff above described the country assumes a more rugged and barren appearance; the hills steep, with deep and narrow ravines; the coast, alternate cliffs and sandy bays, with prominences rocky and rugged.

In $29^{\circ} 10'$ N. is a cove, marked on the charts *Reguala* or *Gueder*. A rocky prominence on each side projects to a short distance; the sides are steep and barren; these are separated by a deep and narrow ravine, down which a slender stream finds its way to the sea. In this cove the water is deep, and bottom clean to the beach: a landing may generally be effected in it, but it affords no shelter.

In latitude $29^{\circ} 3'$ the mountainous country terminates, and a sandy desert commences. There is also a break in the coast, which seems to be the dry bed of a river, and is called by the Canarians *Rio de Playa Blanca*, or White Beach River. At four miles to the southward of this the coast is of bold sand-stone cliffs, with sand downs in the interior devoid of herbage, and thus it continues to Cape Noon, in latitude $28^{\circ} 45' 45''$, as shown in page 27.

CAPE NOON presents a cliff of sand-stone 170 feet above the sea; but owing to the cliffs, to some distance on each side, being of the same height, and the country inland a flat desert, it is difficult to make out the exact projection till very near it. The cape is steep-to, and clear of danger.

Here the depth gradually increases outward, and at the distance of four miles from shore the depths are from 30 to 34 fathoms, bottom of reddish sand; at 12 miles, 57 fathoms, dark sand; and at 30 miles, 98 fathoms, coarse red sand; the water then deepens very suddenly. For a long distance, both to the northward and southward of the cape, as well as to seaward, the water is very much discoloured. It has a red tinge, and is so thick that the track of a ship is visible for a length of time.* At four miles to the southwestward of Cape Noon is the *River Shleema*, (the Akassa of the charts,) and at 31 miles more, in the same direction is the Akassa, in latitude $28^{\circ} 19'$. (This must be the Inoon of the Chev. de Borda, given in page 27.) Each river has a bar, but both appear to have deep water inside, and the banks of both are verdant and fringed with shrubs.

The Shleema, when well open, may be recognized by two remarkable hills, which will then appear in the centre of the gap: they are conical, and on one of them, 325 feet high, are some ruins, said to be those of a fortress. The coast between Cape Noon and the Shleema affords secure anchorage, with moderate depth of water, from the month of March to October.

WEDINOON, or NOON, is a kind of intermediate depôt for merchandise on its way to Soudan, and for the produce of Soudan going to Mogodor. Gums and wax are produced here in abundance; and the people, being independent, indulge in the luxuries of dress, and use many European commodities. A great quantity of gold-dust is bought and sold here. They sometimes trade to Mogodor, but prefer selling their merchandise on the spot, being unwilling to trust their persons and property within the territory of Marocco. With Tembuctoo, however, they carry on a constant and advantageous trade, and many are immensely rich. They also supply the Moors of Marocco with convoys through the desert to Tembuctoo.†

The coast line between the Shleema and Akassa, (or Inoon) is a continued sand-stone cliff. A table land, about 900 feet high, at three miles from the shore, shows just above the cliffs, near which there is a regular depth of 20 fathoms, with good ground. On approaching, the table land appears to break into detached hills, one of which, 950 feet high, and more insulated than the others, serves to identify the river.

The FISHERY carried on by the people of the Canaries commences near the parallel of Cape Noon, the fishermen seldom venturing to the northward, although fish are equally abundant, from their dread of the Moors, who, on that part of the coast, possess boats. From the Cape to the Bank of Arguin, (an extent of 200 leagues) the inhabitants of the Desert have not a single boat. The fishermen frequently land, not only to procure water,

* This discolouration is attributed, chiefly, to the vast quantities of sand blown from the desert.

† To those who wish for further information on this subject, we recommend the valuable work by Mr. Jackson, already quoted. See, also, Journal of the R. Geog. Soc. vol. vi. p. 297.

but to barter their fish for wood and orchilla ; on these occasions great precautions are taken, as atrocities have frequently been perpetrated on both sides.

From the River Akassa (Inoon of Borda?) the coast and country continues as described above. The cliffs are about 120 feet in height to the latitude $28^{\circ} 7'$ or the Porto Cansado of the charts. Here the cliff terminates, and a low sandy beach begins, continuing in a S.W. direction 18 miles, to lat. $28^{\circ} 2'$, long. $12^{\circ} 14'$, where there is the entrance of the *Porto Cansado* of the Portuguese, which is described in the Narrative of Judah Paddock, as given hereafter. The entrance of this harbour is narrow, widening inside, and forming a sort of lagoon. The sea breaks heavily across, and, at times, it is barely possible that boats may enter. Its only distinguishing mark is a table hill, 580 feet high above the sea.

Nothing can be conceived more dismal than the appearance of the shore hereabout. For many miles not a dark spot is to be seen to break the monotonous appearance of the sand ; the fine particles of which, mingling with the haze occasioned by the heavy surf, render the coast very indistinct.

From Porto Cansado the coast trends westward to *Cape Juby*, in $12^{\circ} 55' W.$ At a short distance to the westward of Porto Cansado a cliff, from 90 to 100 feet in height, again commences, and continues for 17 miles. This cliff is of dark sand-stone, and the bottom, being also of dark sand, gives a green appearance to the water. A flat desert extends inland as far as the eye can reach. There is no beach, the sea breaking against the cliffs, on which it appears to be encroaching. Where the cliffs terminate the land becomes broken into sand-hills partly covered with bushes, and the coast trends in a *true* direction $S. 80^{\circ} W.$ to Cape Juby, 15 or 16 miles.

Cape Juby is a low sandy point ; near its extremity is a hummock covered with bushes, appearing like an islet. Rocks extend from the cape to one-third of a mile. Here the coast changes abruptly to S.W. (*true*) and forms some coves, off the points of which are scattered rocks. From Cape Noon to Cape Juby the bank of soundings extends to an equal distance, and the depth decreases very gradually to the shore.

CURRENTS ALONG SHORE, BETWEEN CAPE SPARTEL AND CAPE BOJADOR.

During five months, (from March till August,) the time occupied by the *Ætna* and *Raven*, in the survey of the coast, a distance of 750 miles, no day passed in which the former was not at least 12 hours at anchor, usually at the distance of from four to five miles from shore, and in positions well adapted for making observations on the currents, which were constantly attended to. Independently of this the *Raven* was repeatedly sent to the distance of 20 and 30 miles from land ; particularly when fixed and conspicuous objects afforded opportunities for ascertaining her exact position : by comparing which with that which should have been given by the course steered, the rate and direction of the current could be ascertained to a considerable degree of exactness.

From Cape Spartel, along the coast, to Arzilla, and also to the distance of seven or eight miles from the shore, a regular tide was experienced, running parallel to the coast ; but its strength was rather greater to the northward than to the southward. In this distance, at 15 miles from land, no tide or current was perceptible.

“ From Arzilla, southerly, a tide was still experienced, gradually diminishing in strength till its direction could not be ascertained. From the parallel of $34^{\circ} 30' N.$ to the distance of 20 miles in the offing, a steady southerly set was first experienced. This current, in the offing, continues invariably to follow the direction of the land ; its velocity increasing or diminishing from the rate of four-tenths to one mile an hour, according to the strength or continuance of the north-easterly winds.

From Mogodor to Cape Bojador, except in particular instances, the current continues invariably to run in the direction of the coast. Its greatest strength is usually at the distance of from three to six miles from the land, gradually decreasing on receding from it. Its average rate between $31\frac{1}{2}^{\circ}$ to $28^{\circ} N.$ is from one half to three quarters of a mile in the hour. At Cape Juby, probably from its stream being in some measure confined by the projecting cape, and perhaps by the Canary Islands, (distant 58 miles,) it increases its rate to one mile and a quarter, but diminishes off Cape Bojador to one mile. It did not appear that this current was influenced by any particular wind, but near shore a tide was generally perceived.”

DESCRIPTION, &c., continued. The various tribes of Arabs, frequenting the coast of the Desert, have already been alluded to, as well as the danger of falling into their power. Their practice has been, when a ship is stranded, and the crew compelled to surrender, to take every thing portable from the vessel in boats: and then, if the sea do not dash it in pieces, they set fire to it, that it may not serve as a warning to other ships which may be so unfortunate as to follow the same course.

Mr. Jackson has communicated a stratagem by which a ship was, many years ago, saved on this coast. The vessel was stranded, and one of the crew, being a Spaniard, who had been used to fish there from the Canaries, advised the captain to let go an anchor, as if the vessel were riding, and in safety. Some Arabs coming on board, the captain told them to bring their gums and other produce, for that they were come to trade with them, and were going away again in a few days. As it happened to be low water, the vessel, on the return of the tide, floated; they then weighed anchor, and set sail, to the great disappointment of the people on shore.

Of the vessels wrecked, from time to time, on the coast of the desert, many are probably never heard of; and, if any of the crew survive their hardships, they are induced, seeing no prospect of emancipation, to become Mohammedans, and nothing is afterward known or heard of them: the vessel is supposed to have foundered at sea, and all passes into oblivion.

It has been stated that, there were about 30 vessels, of different nations, the greater part English, lost on this coast between 1790 and 1806, part of whose crews found their way to Morocco, and gave some account of their catastrophe; of the remainder, a number were subsequently ransomed; but the majority were either lost, or dispersed in various parts of the desert, after a lapse of time, in consequence of the consul's making no offers sufficiently advantageous to induce the Arabs to bring them to Mogodor.

Upon this subject we find the following passages in *Mons. Golberry's Travels in Africa*:—"These Moors undertake very long journeys, crossing the deserts in every direction. On the banks of the Senegal and Niger they make prisoners of straggling or shipwrecked individuals, whom they convey toward the Mediterranean, and sell for slaves.

"The tribes of Moors who constantly trade with us in the Senegal are three in number, distinguished by the names of *Trarshaz*, (Tarassas of Jackson,) *Brachknaz*, and *Woled El Haghi*, or *Darmanko*.

"Discontented individuals of these three tribes have formed themselves into a horde, who live by pillage and rapine. They traverse the coasts from the Senegal to Cape Boiador, and make a trade of watching for shipwrecks: their spies, who are dispersed along the coast to the distance of more than 100 leagues, correspond with each other by means of signals; and, when a vessel, which they often lead astray by perfidious marks, imprudently approaches land, and runs aground, these savages immediately plunder it, seize on the unfortunate crew, make them captives, and treat them with disgusting barbarity; or else they sell them to the neighbouring hordes, by whom they are conveyed, in a state of slavery, to Morocco.

"This horde is designated the *tribe of thieves*, and do not blush at this odious denomination.

"The administration of the Senegal made annual presents to the chief of this banditti, whose rendezvous was in the oasis of Gualata, to induce them to save individuals wrecked on the coasts, and bring them to the Isle of St. Louis. For each slave made in this way, it is added, the English gave a bounty of ten guineas."

WRECK OF THE SHIP CHARLES, 1810.—In the year 1816, was published, "The Narrative of Robert Adams, a sailor, who was wrecked on the western coast of Africa, in the year 1810; was detained three years in slavery by the Arabs of the Great Desert, and resided several months in the city of Tembucoo. With a map, notes, and an appendix:" 4to.

From this work we learn that, the American ship *Charles*, John Horton, master, sailed from New York on the 17th June, 1810, being laden with flour, rice, and salted provisions, and bound to Gibraltar. In twenty-six days the vessel arrived at that place, where the cargo was discharged. She lay at Gibraltar about a month; and, after taking in sand-ballast, 68 pipes of wine, some blue nankeens, and old iron, proceeded on her voyage, the captain stating that he was bound to the Isle of May for salt; but afterward it appeared that he was going

going on a trading voyage down the coast. When they had been at sea about three weeks, Adams heard two of the crew, who were old sailors, and who had been on the coast before, speaking to the mate, stating their opinion that the captain did not know where he was steering: the advice was disregarded, and they had to beat against contrary winds for eight or nine days afterward; and on the 11th of October, about three o'clock in the morning, they heard the breakers; when Matthews, the man at the helm, told the mate, who was keeping watch, that he was sure they were near the shore; to which the mate replied that, "he had better mind the helm, or his wages would be stopped." An hour afterward, the vessel struck; but there was so much fog that the shore could not be seen. The boat was immediately hoisted out, and the mate with three seamen got into it; but it instantly swamped. The four persons who were in it swam, or were cast ashore by the surf; soon after, the sea washed off four or five more of the crew, including Adams; but, as most of the ship's company could swim, they all reached the shore. When morning came, it appeared that the ship had struck on a reef of rocks, extending about three-quarters of a mile into the sea, and were more than 12 feet above the surface at low water. The place, according to the captain's reckoning, was about 400 miles to the northward of Senegal. Soon after break of day, they were surrounded by thirty or forty Moors, who were engaged in fishing on the coast, by whom Captain Horton and the ship's company were made prisoners. The vessel bilged, the cargo was almost entirely lost; and what remained of the wreck was burnt by the Moors, for the copper-bolts and sheathing; but as they had no tools wherewith to take off the copper, they saved little more than the bolts.

"The place, which was called *El Gazie*, was a low sandy beach, having no trees in sight, nor any verdure. There was no appearance of mountain or hill; nor (excepting only the rock on which the ship was wrecked) any thing but sand as far as the eye could reach. The Moors were straight-haired, but quite black; their dress consisted of little more than a rug or skin round their waist, their upper parts, and from their knees downward, being wholly naked. The men had neither shoes nor hats, but wore their hair very long: the women had a little dirty rag round their heads, by way of turban. They were living in tents, made of stuff like a coarse blanket of goats' hair and sheep's wool interwoven; but some of them were without tents, until they made them of the sails of the ship; out of which they also made themselves clothes."

The Moors stripped all the crew naked; and their skins, by being exposed to a scorching sun, were dreadfully blistered. The captain was soon taken ill; and having been provoked to show somewhat of violence toward the Moors, they seized and murdered him. After remaining at *El Gazie* ten or twelve days, the Moors prepared to depart, and divided the prisoners among them. Adams, Dolbie, (the mate,) and Newsham, (a seaman,) fell to the share of about twenty Moors, who quitted the coast, with four camels laden with water, fish, and baggage. They travelled on foot, at the rate of fifteen miles a day, in an easterly direction, and in thirty days arrived at a place containing thirty or forty tents, where they found a pool of water surrounded by a few shrubs, which was the only water they had met with since quitting the coast."

The subsequent adventures of Adams, &c. are irrelevant to our purpose. We, therefore, only add, that he was ultimately sold at Wed-inoon, and was ransomed thence by Mr. Joseph Dupuis, the British consul at Mogodor. Being unwilling to come to England, Mr. Dupuis sent him to Tangier, whence he passed over to Cadiz, where he arrived on the 17th of May, 1814, making three years and seven months since he was wrecked. Circumstances afterward brought him to London, and the result has been the narrative, by Mr. Simon Cock, to which we owe our knowledge of these facts.

WRECK OF THE BRIG COMMERCE, 1815.—"The American brig *Commerce*, Jas. Riley, master, sailed from Gibraltar for the Cape Verde Islands, on the 23d of August, 1815. Soon after the vessel had left Cape Spartel, the weather became so foggy that scarcely any observations could be taken; and to this cause are referred the errors in the reckoning, which produced the loss of the vessel. Some doubts arising in the mind of the master, when, by the log, he judged himself to be about thirty miles north of Cape Boiador, he was induced to determine hauling off to the N.W.; but before his orders could be executed, breakers were heard under the lee. He, in vain, attempted to stand off; the vessel was carried by a current and the sea directly toward the breakers; she, consequently, took the ground: surge after surge came on, and she was driven, notwithstanding anchors, which had been let go, partly with her head on shore, where she struck with such violence as to start every

man

man from the deck. It afterward proved that the scene of this calamity was near Cape Boiador, and there can be little doubt that the brig had been carried to the southward by the current. As the vessel soon began to fill with water, and seemed in momentary danger of going to pieces, the long-boat was quickly hoisted out; some of the articles, most valuable under present circumstances, were placed in it, and the crew, with difficulty, reached the shore. They had scarcely landed, and began to secure their effects from the sea, when a human figure, whose complexion was between that of a negro and an American Indian, made his appearance: his form and face are described as hideous. Some women and children soon joined him; and, feeling themselves strong, they commenced an indiscriminate plunder. Riley and his crew had no fire-arms, but might have defended their property with pikes, had they not been afraid of irritating these people, of whose numbers, in the vicinity, they were uninformed. Such, however, was the effect produced on them by this visit, that they determined to regain the wreck in their shattered boat; which, after the departure of the savages, they reached with great exertions and continual baling. Thence they saw the plunder of their effects continued on the shore, and all the articles which the Arabs did not want were consumed by fire. Riley was afterward tempted to venture again to land by a show of friendship in the natives; and, having accomplished it by means of the hawser, he was there detained as a hostage while the old Arab went to the wreck; but the latter, not finding in the vessel any of the objects of his search, soon returned to the shore.

Mr. Riley was now in a most critical situation, and was menaced with instant death unless a treasure of dollars was produced from the wreck. As the noise of the surf prevented his voice from being heard by the crew, he partially made himself understood by signs, and some dollars were accordingly pushed in by means of the hawser. This booty did not act, however, as it was expected, in the way of ransom, and the captain had recourse to another device, more crafty than honourable. He had on board an old man, Antonio Michel, (not enumerated in the list of the crew,) who, by signs from Riley, was sent on shore: and, when he arrived, he was employed by his master to point out some spots in the sand where various articles had been buried on the first landing. This fixed the attention of the Arabs, and, during the process, Riley found means to throw himself into the sea, and regain the boat, which was alongside the wreck. On the discovery of his departure, 'poor Michel instantly fell a victim to the fury of the natives.

The boat was now the only resource for the unfortunate crew, and to that they committed themselves and all their hopes; putting to sea in this leaky conveyance, with two of their number continually baling out the water. At last, their provisions failing, and the leaks increasing to a considerable degree, they were persuaded by their captain to steer to land; which they reached with difficulty on the 7th of September, at a promontory, as they afterward found, a little to the north of Cape Blanco. They were compelled to pass the first night on the beach, as they could discover no part of the rock that afforded the possibility of an ascent, and, when they did gain the summit, at some few miles distance, on the following day, they beheld before them an endless plain, 'without a tree, shrub, or spear of grass, that could give the smallest relief to expiring nature. The shock which they thus experienced is forcibly described. Toward the evening, when they were almost fainting with thirst, a light was perceived; and such were their present necessities, that when they discovered whence it proceeded, they were willing to accept slavery under the Arabs in the Desert, in exchange for the hope of life, and a drop of water to moisten their burning tongues. They did not, however, surrender themselves during the night; but the Arabs observed them, when at some distance, in the morning, and ran toward them; when the captain, taking Mr. Williams and Mr. Savage, his mates, with him, went forward to meet them, bowing himself to the ground before them, and, with signs, imploring their compassion. The prize of so many Christian slaves caused no small contention among the natives; and, after the captives had been all stripped to the skin, each Arab claimed those as his property whose dress he had allotted to himself. A battle, by no means bloodless, but not terminating fatally, ensued; and it was at length decided, by the arbitration of the scimitar, that Riley and Savage, with three others, should remain with one party, while the rest, mounted on the bare backs of camels, were carried in a different direction by another. Of the latter no more is known, other than that Porter, one of them, was afterward ransomed, and brought to Mogodor, and that intelligence had been received of three of his companions.

Although Riley's companions remained with one division of the Arabs, they were the

property of different masters, and with them they proceeded into the Desert: still naked, nearly starved, excoriated in a dreadful degree by riding in that state on the hard backs of camels, blistered over the whole body with the intense heat of the sun, and when obliged to drive the camels, their feet were cut nearly to the bone by stones almost as sharp as gun-flints. The description of their sufferings, indeed, exceeds any thing of a similar nature which we recollect to have read of. In this state, they were driven forward with blows; and, as their masters were in great distress, from the failure of provisions and water, the captives were limited in their sustenance to such a degree as to render it wonderful that the vital spark could have been preserved. When they had proceeded to the S.E. for more than a week, they were compelled to return toward the sea by the want of water; and, during their whole journey, the abhorrence of the white men, expressed by the women, was such that they were never admitted to the tents at night, but were exposed to the hard and flinty ground, where the *luxury* of a bed of sand could not be procured, and the cold cut them to the quick.

“They had passed fourteen days in this calamitous state when they were met by two Arab merchants from Morocco, Sidi Hamet, and Seid, his brother. Riley persuaded the former, by repeated intreaties, partly by signs, and partly in the few words in the language of which he had become master, to purchase him, and convey him to Suerrah (Mogodor). A bargain was accordingly struck for the extent of the ransom, to be paid by a friend, whom Riley represented himself to have at the city; which he did in reliance on the humanity of any of the European consuls who might hear of his captivity. He was ultimately still further successful in inducing the two brothers to embark in the speculation of purchasing his comrades also, with the view of equal reward; but this was done with the exception of a black cook. In this situation the sufferings of the party, in some measure, were mitigated, but they were still dreadfully severe. Sidi, on many occasions, evinced a compassionate disposition, but his brother was a savage in every sense of the appellation. Mr. Riley continued about six weeks in this servitude, journeying to the north, in a line nearly parallel to the sea, and, in some places, near the shore; perpetually reminded, even by Sidi, of the forfeit of their lives, in case the expectations of their purchasers should not be realized. Several attempts were also made to intercept them or steal them away, by parties of the Arabs. On the 19th of October, they first arrived in the habitable country of Wedinoo, in Lower Suse, where Riley was supplied with some scraps of paper, on which he contrived to write a letter, addressed to the consuls of the English, French, Spanish, or American, nations. Sidi Hamet went forward with the letter; and, after a suspense of eight days, an answer was returned by a Moor in the confidence of Mr. Willshire, the English consul, Sidi having been detained at Mogodor.

“The eighth day of my master’s absence passed tediously away, when, after dark, we heard a trampling outside the walls; Seid went forth to learn its cause, and soon returned with Sidi Mohammed, followed by a well-looking Moor:—they came directly to that part of the yard where we were sitting on the ground, trembling with apprehension and with cold. When they came near us, the Moor called out, and said in English, ‘How de-do, Capetan?’ This raised me and all my men from the ground; I felt as if my heart was forcing its way up into my throat, and it entirely obstructed my breath. I eagerly seized his hand, and begged to know who he was, and what was my doom; and if Sidi Hamet had come back. He then asked me, in Spanish, if I spoke that language, and being answered in the affirmative, he informed me, in Spanish, that he came from Mogodor, that my letter had been received by one of the best of men, an Englishman, who was my friend, and who had shed tears on reading my letter; that he had paid the money to my master immediately, and had sent him (the Moor) off, without giving him scarcely a moment’s time to take leave of his wife, and that he had been on his mule ever since he left Suerrah, travelling on as fast as possible, night and day. The anxiety of my companions, by this time, had risen to such a pitch, that they broke in upon his story, on which I communicated to them the thrice welcome and happy intelligence, that we had a friend who would redeem us from slavery. Our souls were overwhelmed with joy, and yet we trembled with apprehension lest it might not be true; at this moment, however, the Moor handed me a letter: I broke it open: but my emotions were such, that it was impossible for me to read its contents.”

The letter, which was read by Mr. Savage, realised all their hopes, and dispelled all their apprehensions. The Consul had not hesitated to advance the money at his own risk; and, as well by his letter as by his subsequent reception of his fellow-Christians, he showed

how

how completely he entered into the spirit, as well as the profession, of our faith. Every thing that humanity could dictate was done for the miserable sufferers.*

WRECKS OF THE OSWEGO, MEDUSA, &c.—Soon after the appearance of Mr. Riley's publication, from which the above particulars have been abstracted, another and similar volume appeared, describing the shipwreck of the *Oswego*, Judah Paddock, master, on the African coast, to the eastward of the Canary Islands. In the month of January, 1800, this ship, of 260 tons, sailed from New York for the port of Cork, with a crew of thirteen persons. Having performed this voyage, and discharged his cargo, the Captain determined to ballast his vessel, go to the Cape Verde Islands, and take a load of salt, skins, &c. for New York. From ignorance of the current setting on this coast, it happened that, on the 3d of April, without any particular stress of weather, the vessel struck, during the night, on the coast of Barbary, somewhere near Cape Sabi, or between the parallels of 27 and 28 degrees. It was the wish of the master to stay by the wreck, until preparations could have been made for a voyage in the long-boat, and it seems that such an attempt would have afforded a fair prospect of success; but his intentions were frustrated by the obstinacy of some of the crew; and the whole party went ashore in the boat, without provisions or water.

From this time the conduct of the crew, or at least a part of them, seems to have been highly censurable, and they were consequently captured by the Arabs, at a time when their means of escape appeared to have advanced. They underwent the same species of suffering described by Captain Riley. The captivity took place on the 6th of April; and, on the 27th of the same month, the party had reached an inhabited and cultivated country, having many days of rest from travelling in the interval. A bargain was early struck with Ahomed, the chief of the tribe, for a price of ransom, on reaching Suerrah, or Mogodor, and they, at length, arrived at Agadier, or Santa Cruz, and thence, on the 16th of May, they came in sight of Suerrah, where the British Consul did all that humanity could suggest both for Mr. Paddock and his companions, and procured the release of him, and of those who had travelled with him, from the miseries of slavery.

It appears probable, from Captain Paddock's narrative, that the vessel had been set considerably to the eastward before she reached the parallel of Cape Finisterre, but the great error, in her reckoning, unquestionably occurred subsequent thereto. In the parallel of Madeira it was, however, supposed that she was, or might be, to the westward of that island; but the vessel, according to observations for latitude, was generally a-head of her reckoning, and in the night of the 3d of April, she struck on the coast, as above-mentioned, upon a reef of hideous rocks. With great difficulty the people landed, by crawling over slippery rocks to a sand-bed, "beyond which appeared a high hill, upwards of 100 feet in altitude." Captain Paddock says, "On the morning of the 4th of April, as soon as the day began to dawn, I ascended the high mountain of sand, and there remained till near sun-rise. What could I see? A barren sand, without either tree or shrub, or the least appearance of vegetation; dreary in every respect; and, at a distance back, a long range of mountains extending east and west." It was next found, by a compass, that the shore extended nearly east and west, and at 10 or 12 miles to the westward a cape projected into the sea, in form of a very square bluff. It seems that the captain had very inaccurate charts; he could not determine the place of the wreck, but supposes it near Cape Sabi, which we represent in $28^{\circ} 10' N.$; and adds, we must thus have been currented eastward more than 200 miles since speaking an English frigate off Cape Finisterre. The country in the vicinity of the wreck was wholly sandy, and at about 8 miles to the south-eastward had every appearance of once having been the bed of the sea.

On proceeding to the north-eastward, the crew arrived at a fine sandy bay on the coast, which is probably the *Porto Cansado* of the Portuguese, as shown on our charts. It has 9 or 10 feet within a cable's length of the shore. The distance across it was estimated at about three miles: the two outer points are broad, closing to within one mile; a ledge of rocks on each point leaving a fair entrance of half a mile in breadth, with deep water. "Against those ledges the sea broke violently, but in the harbour it was smooth: from the windward side of the harbour a ship might lie very well, with the wind as it then was, which blew strong four points on shore or at North-east. Had our situation been less

* The Volume, from which these particulars have been extracted, was published in London, 1817, at the price of 36s. It comprehends, however, an account of Tembucoo, and much interesting information relative to the interior trade and condition of Africa.

deplorable, I should have been led to examine this fine-looking harbour, more particularly. Should any national vessels ever undertake to survey this coast, they will, beyond doubt, visit it. From our judgment, being on shore, it would appear, from the offing, a nearly straight shore, as the two outer points, or chops, of the harbour would, except being near in, seem nearly to close on the western side of the harbour. Where we stood to look at it, the bank was high, and from sea-board would, in my opinion, appear like a high round knoll; the mountain back, only a few miles distant, would appear black, at least of a dark colour, and the top flat for several miles each way, running E.N.E. and W.S.W." On this nearly flat mountain, supposed to be nearly 400 feet in height, above the level of the sea, is a remarkable bed of salt, about a mile in diameter. Hundreds of ships can ride in the harbour in safety, defended from all winds except the north-west; and, as the entrance is so much narrower than the body of the harbour, no sea through that gut can hinder ships very much, the ground being perfectly clear. (*See Remarks by Lieut. Arlett, page 294.*)

Captain Paddock adds, a survey of this coast, if done in the summer season, would neither be difficult, nor attended with risk, provided there were employed two or three fast-sailing small vessels, furnished with good cables and anchors. There is a great number of anchoring-places along the coast at sea-board; and, although those situations are very rough, yet in that respect they are nothing in comparison to the anchorage on the Grand Bank: and, should a cable happen to part, or circumstances make it necessary to be cut, there would be no risk of going ashore; for, when I was on that coast, a vessel might be within two or three points of lying directly off shore. I learned from the Arabs that the Spanish fishermen frequently anchored near it, and by signs from them came ashore and traded with them, giving fish for skins, or for sheep's wool. In carrying on this trade, the plan they adopted for their own security, as Ahomed once related to me, was this:—"We approached," he said, "to the sea-side with our goods, and left one man with them, all the others returning back out of the reach of gun-shot. The Spaniards then landed, and made their agreement with this one man, he keeping himself so far from them as not to be within reach of their grasp, always ready for a start, and having full confidence in his heels." Ahomed acknowledged that this trade was conducted fairly by the Spaniards. According to his representation, they often lay at anchor within a cable's length of the shore.

"Happy would it have been if, fifty years ago, a good survey of this coast had been made and published to the world. A delineation of the very strong currents, especially, might have saved a number of fine ships and a great many valuable lives. While I was in Mogodor I examined a great number of protests, made by masters or other officers upon oath, relating to ships that had been wrecked on that coast, and all of them attributed their losses to the currents that had swept them away, most of them to a great distance from the place where they had calculated their ship to be. *Not one of these ships was protested to be lost by stress of weather. Indeed, there is no doubt, in my own mind, that many missing ships, carried by the currents along this inhospitable coast, have been wrecked and never more heard of.* A vessel, in coming here, seldom meets with any shoal or rocks to strike on, till it strikes upon one of the many square and perpendicular bluffs, against which the sea beats with such violence that it must go to pieces in a very few minutes, and every soul inevitably perish. This circumstance, viewed in connexion with the great quantities of pieces of wrecks scattered along that coast is sufficient, I think, to support the opinion which I have advanced."—(Paddock's Narrative, pp. 19, 340, 1, 2.)

After the above was written, we received the affecting narrative of the loss of *LA MEDUSE*, French frigate, on the Arguin Bank, to the southward of Cape Blanco, on the 2d July, 1816; which may probably be attributed to a similar cause,—the direction of the currents. It has been justly observed that, the annals of naval distress do not offer a more terrible instance of shipwreck. *La Meduse* sailed, 17th June, 1816, from the Isle d'Aix, under the command of *M. de Chaumareys*, having on board 240 persons; of which the greater portion consisted of soldiers intended to garrison those forts, at the mouth of the Senegal, which had been restored by the treaty of peace: they were accompanied by the newly-appointed governor of that place.

The ship ran aground on the bank, in the parallel of $19^{\circ} 36'$. A great consternation ensued; and, after many angry deliberations, it was resolved, as they had only six boats on board, to break up the vessel, and with its materials construct a raft large enough to place the soldiers on it, who were thus to be towed ashore.

On the 5th July, the embarkation from the wreck took place, in the greatest confusion.

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One hundred and forty-seven persons, (including the captain and surgeon,) were confided to the raft. The precipitation with which it was built prevented its being fitted with railings. It was about 60 feet long; and if solidly put together, would have been able to bear two hundred men: but it was weak and ill-constructed, without sails or masts. There were placed upon it a number of quart-measures of flour, five barrels of wine, and two casks of water.

"Scarcely had fifty men set foot on the raft, when it sunk at least two feet. To facilitate the embarkation of the rest, all the flour was thrown into the sea: the wine and water alone were preserved. With the whole number on board, the raft was sunk at least three feet, and so closely were they huddled together, that it was impossible to move a single step. Fore and aft the water was up to the middle of the unfortunate sufferers.

"It had been settled, that all the boats of the frigate were to tow us, and the officers who commanded had sworn that they would never abandon us. The boat in which the governor was, threw to us the first towing rope. If all the efforts of the boats had constantly acted upon us, favoured as we were by the sea-breeze, we should have reached land in less than three days, for the frigate was not wrecked more than 12 or 15 leagues from the shore."

By the boats, however, the raft was inhumanly abandoned: it was thus left to its fate, amidst all the horrors of famine. In an element which already covered one half of their bodies, the greater part of those upon it at once yielded to despair.

For twelve days this was the condition of the survivors: we say *survivors*, because during this time, the number had rapidly diminished.

In the first night the wind freshened, and there was a considerable swell of the sea: the people tumbled over each other; and, in the morning, ten or twelve were found dead, with their lower extremities entangled in the interstices between the planks of the raft: others had been carried off by the sea. Day passed away, and a night succeeded more dreadful than the former; many perished. In the morning many others gave themselves up for lost, and fell to drinking until they had lost their reason. A mutiny ensued. The captain was thrown into the sea, but recovered by the officers and passengers. In the night many soldiers appeared to be mad: a battle took place, and the morning discovered that sixty-five men had perished.

The recital thus describes the melancholy events of the twelve days; during which time a principal portion of sustenance was derived from the bodies of deceased companions! At this period only fifteen men remained, and these were happily discovered and taken off, on the 17th of July, by the *Argus*, French brig, which restored them to their country.

Other instances of ships lost upon this coast might be given; but those selected will be sufficient for our purpose.

CAPE BOIADOR to CAPE BLANCO.—The tropical regions of the African coast, between Cape Boiador and Cape Blanco, present to contemplation the *Sahara*, considered as the most extensive desert on the globe. This desert consists of inadhesive sands, which are driven about by the winds, and chiefly by those from N.E., by which they are disturbed and carried to an astonishing distance. This circumstance has been noticed by Mr. Luccock, and we have met with other notices to the same effect in *MS. Journals*. Of the merchant-fleet, from St. Helena, under convoy, in November, 1813, most of the ships had their sails covered with the *red sand*, when they must have been from 400 to 500 miles from shore, in about 27° and 28° N., after a succession of easterly winds. "I once," says Mr. Luccock, "saw the sails and deck of a vessel covered with it, when 400 miles from the coast, and have heard of the same phenomenon being remarked at a far greater distance. This moving expanse of sand was probably, at some anterior period, a large inland shallow sea, communicating with the Mediterranean by the Syrtis, [Gulf of Sydra,]" &c.

CAPE BOIADOR is represented by the *Chev. de Borda* in lat. $26^{\circ} 12\frac{1}{2}'$, but the late surveys exhibit it in $26^{\circ} 7'$ only. The cape has some rocks about it, but on its south side is a bay affording anchorage in 4 and 5 fathoms, and ships may anchor farther out in from 15 to 20 fathoms, within a league of the shore, on a bottom of sand, broken shells, &c.

The Baron Roussin says that, the coast to the northward of Cape Boiador is similar to that of the desert to which it belongs. It is arid and sandy, the only signs of vegetation being a few small tufts of dried brambles scattered promiscuously here and there. It presents

sents no other variety than some flat downs of a tabular form, whose base can scarcely be seen at the distance of three miles from the beach. The nature of its soil is exclusively siliceous, being sand without any mixture whatever. The surface of this immense plain is so completely horizontal that it actually appears to have been levelled. In some places on the coast, it terminates in a steep cliff, and in others in a gentle descent toward the sea. These cliffs are streaked with horizontal beds of different shades approaching to white; the lower ones being generally thinner, and of a more reddish cast than the upper. To the northward of the parallel of 23° N., this soil is overspread with a crust of black earth, which from its being nearly general, may be taken as its covering, and is of a tolerable thickness. This species of crust, no doubt, derives its consistency from the great humidity which it contracts during the rainy season, and the extreme heat to which it is again suddenly and constantly exposed. By the repeated shocks of the sea, huge masses of this black crust fall to the bottom of the cliffs, and relieve the sameness of the shore. They first resemble rocks on which the sea breaks, but their corners are soon worn away, and they soon present but a heap of sand. On the whole extent of the coast, as far as Cape Verde, there is not a single piece of granite. Cape Boiador, which lies in $26^{\circ} 7' \text{ N.}$ and $14^{\circ} 30' 34'' \text{ W.}$, is not very remarkable. When seen from the northward, it presents a strand of red sand, having a gradual descent toward the sea: and its western extremity, which is very low, forms a small bay with the cliff which immediately follows. The position here given, is that of the easternmost point of the cliff, which has been selected as the most remarkable one in the neighbourhood; its height being about seventy feet. The depth along the coast, three or four miles to the northward of Cape Boiador, varies from 12 to 20 fathoms, increasing gradually toward the parallel of the cape. The nature of the bottom, throughout, is of sand and broken shells, or of sand and gravel. At the distance of three leagues to the seaward, there are 25 fathoms of water; and the sandy bottom becomes more general: a circumstance which is common to all the African coast.

It is possible to anchor in the small bay of Cape Boiador, but the bottom is foul. At the distance of half a mile from the shore, there are 13 and 14 fathoms of water.

From Cape Boiador the coast trends S.W. $\frac{1}{2}$ W. [$S. 20^{\circ} \text{ W.}$] about twenty-two leagues, to a very remarkable cliff, about three hundred feet high. This cliff seems to be the *Penha Grandé*, or *Great Rock*, of the Charts. As its height considerably exceeds that of any spot in its vicinity, it may serve as a good land-mark.

All the coast thus far presents, alternately, cliffs and sandy beaches; but more particularly the former. It is from 150 to 200 feet in height; being flat at its summit. The land in the interior, on which brushwood is very scarce, is of a darkish colour.

The depth of water on this part of the coast is considerable. At two miles from the beach, bottom cannot be found at 22 fathoms. On the parallel of $25^{\circ} 50' \text{ N.}$, and at one mile and a half from the shore, bottom may be had in 15 and 20 fathoms, gravel and broken shells. The depth again increases; and under the *Penha Grandé*, at a mile from the foot of the cliff, there are twenty-six fathoms, hard bottom, with gravel and broken shells. The summit of the *Penha Grandé*, is in $25^{\circ} 7' 6'' \text{ N.}$ and $14^{\circ} 50' 53'' \text{ W.}$; it is flat and arid; all its declivities are precipices from broken earth, which has fallen down, the colour of which is gray. The whole of this coast is perfectly clean, even to the beach.

From the *Penha Grandé*, after a slight indentation, the coast trends S.S.W. $\frac{1}{4}$ W. [$S. 6^{\circ} \text{ W.}$] eight leagues, and includes a slender bay, now called *Garnet Bay*. It then forms a well-defined elbow, and trends nearly S.W. by W. $\frac{3}{4}$ W. [$S. \text{W.}$] 29 leagues. On all this extent, it presents one continued cliff, with the exception of two or three places, where it slopes down to the sea; the cliff being about one hundred and fifty feet high. Frequently, at a short distance from the water's edge, between the cliff and the sandy rocks which here cover the beach, there is a chain of white sandy downs. The summit of the cliff is even and horizontal, it follows nearly a right line, interrupted only by some small flat downs scarcely perceptible. The whole of this beach is continually washed by an exceedingly heavy surf, and there is no sign of vegetation on the whole coast.

GARNET BAY, which is the *Angra dos Ruivos* of the Portuguese, abounds with cod, bream, hake, and various kinds of other fish. Two leagues to the southward of it are seven small table hills, called the *Seven Capes*, which constitute an excellent land-mark.

From the elbow formed by the coast, on the south side of Garnet Bay, to the south-westward, the depth diminishes a little; from 16 fathoms it gradually lessens to 11 fathoms, and continues nearly the same in a space of six miles. We shall now have arrived at the parallel

parallel of 24° N. and immediately abreast of an interruption in the cliff, at a beach of white sand, about a league in extent. Beyond this sand, which does not reach far into the interior, is a body of still water, having the appearance of a lake or river, with a sandy islet in the middle of it. This is the upper part of an inlet named *Rio do Ouro*, or *Gold River*.

Continuing a south-westerly course, along a neck of sand, which separates the river from the ocean, and which is alternately interspersed with cliffs, after running ten leagues from where it was first observed, we arrive at its entrance. In this run, at the distance of one to three miles from the shore, the soundings vary from 16 to 8 fathoms with a hard bottom and shells. On approaching the river white sand will be found.

RIO OURO, OR GOLD RIVER.—The entrance of this inlet is in $23^{\circ} 36'$ N. and $15^{\circ} 58\frac{1}{2}'$ W. Its breadth, taken from the outer cliff on the west bank, to the cliff on the bend of the coast forming the east bank, is seven miles and a half; but a very low sandy point stretches to the southward from the west bank in such a manner as to leave only a free channel of a mile in width at the utmost.

Neither to the northward, nor at the entrance of this channel, does any island exist, although the old charts mark several; but at twenty miles to the N.E. of the northern point of the entrance, and on the meridian of the islet in the interior before mentioned, there is a cliffy mount of sand, which, being insulated on a low sandy flat, might have been mistaken for an islet. This, however, forms a part of the bank with which it is connected at its southern point.

No particular current was observed off the Rio Ouro, which consequently does away with the supposition of a river emptying itself by this opening. At the distance of about three miles seaward from the mouth of the inlet, the bottom is of sand and shells, with a depth varying from 9 to $16\frac{1}{2}$ fathoms. In the middle of its entrance is a circular breaker, one mile in diameter, on which there appears to be very little water. The northern point is wholly surrounded by breakers, but they are only a continuation of the surf, which is found on the whole coast. The adjoining sea is well stocked with fish.

From the southern point of the Rio Ouro, the coast trends nearly S.W. [S.S.W.] The cliff continues to a distance of five leagues, when white sandy downs succeed, of which the summits are mostly flat. At one league northward [N.N.W.] from the extremity of the cliffs, and at three miles from the coast, there is a bank, having only 32 feet of water; its direction is parallel to that of the coast, and it is about two miles in length. Thirteen fathoms have been found on the edge of this bank; to the northward of it, the bottom is sand and shells; to the southward, fine sand; and on the bank itself, broken shells.

ANGRA DE CINTRA, OR CINTRA BAY.—At the distance of three leagues from the southern extremity of the *Fisherman's Cliffs*, or the cliffs of the Rio Ouro, amongst a number of even downs, there is one somewhat elevated above the rest, extending parallel to the coast. From being flattened at its summit, and having its southern extremity peaked, it becomes remarkable. It is situated at a short distance from the beach, at the head of a small bay, named *Angra de Cintra*. This bay is sheltered, on the North, by a very low sandy point, which, detaching itself from the coast, runs parallel to it, and a reef projects from its southern extremity, which may be considered as a continuation of it. The break in the coast, between the northern and southern reefs, which forms the opening of this bay, may be about six miles; but, on doubling the northern reef, the bay is found to extend about four miles inside of the sandy point which protects it.

The depth of water in this bay is not great; at the distance of a mile inside it are only $4\frac{1}{2}$ fathoms, sandy bottom; but the stillness which prevails in it attracts a great number of fish, and it forms a harbour for the night to the fishing vessels of this coast. It is to be observed that, besides the reefs stretching from the north and south points of the bay, there is also a rock near the middle of the entrance, which breaks in blowing weather.

All the coast from the Bay of Cintra to the Rio Ouro is well stocked with fish, and is frequented by eighteen or twenty small vessels from the Canary Islands, which catch and salt fish for the consumption of those islands. Fresh water may be obtained, by digging at the foot of the high down or sandhill, above mentioned, as a place of observation.

It does not appear safe to attempt the channel into Cintra Bay, between the point and the northern reef, as the breakers seem to be connected between them; but the entrance to the southward of this danger is quite safe. The least depth found was 6 fathoms, in the middle of the entrance. During the time of the rollers, as the sea breaks over this 6 fathoms,

fathoms, vessels should pass either to the northward or southward, where they will find from 9 to 10 fathoms. The fishermen who frequent this creek attract some few Arabs or Moors to the spot, who seem to have no fixed habitation there, nor on any other part of the coast. These belong to the fourth tribe, who are dispersed in the desert, and called the "tribe of thieves," complete wanderers and vagabonds. It is composed of the discontented of the three tribes already mentioned, in page 295, and which are scattered along the coast from Cape Boiador to the Senegal; they subsist exclusively on dried fish, and the plunder from wrecks, *which formerly were so frequent here*. No advantage can be derived from a communication with these poor and miserable barbarians.

In the Bay of Cintra, at two miles from the beach, are from 9 to 16 fathoms of water, the bottom of sand, sand and gravel, sand and shells, sand and mud, generally covering siliceous or flinty rock, of the same nature as the neighbouring coast. Toward the bottom of the bay the mud becomes thicker, and here the anchor would sink deep into a bed of greenish clay, which is excellent holding ground.

The Down of Cintra, according to M. Roussin, is in $23^{\circ} 5' 25''$ N., and $16^{\circ} 10'$ W. The magnetic variation on the same parallel, at two miles from the shore, in February, 1817, was $19^{\circ} 33'$ W.

Anchorage may be found along the coast from Cintra Bay to the Rio Ouro, but the bottom, from being composed of siliceous rocks, must be unfavourable for holding.

From Cintra Bay the coast trends S.S.W. $\frac{1}{2}$ W. [$S. 10^{\circ} W.$] to a distance of 7 leagues; the shore is low, but it gradually rises and becomes a continued down of white sand. At three leagues to the southward of this bay, in the interior, may be seen four or five small insulated sandy downs, which are rather higher than the adjacent ground, and, with the lower one, may serve as a mark for this coast. These heights are called the *Downs of Cintra*, and they can be seen at the distance of four or five leagues only.

ST. CYPRIAN'S BAY.—Having run six leagues and a half along a moderately high coast, which presents alternately cliffs and sandy beaches, we arrive at an inlet, or bay, formed by rather a deep bend of the beach. The bottom of this bay is low, and the sea breaks violently on it. The eastern point of the bay is formed by a cliff, one hundred and fifty feet high, having a circular form toward the sea, with a flat top, and much resembling a fortification. The western side is also formed by a steep cliff, which, after extending two miles and a half to the westward, turns abruptly to the S.W., and forms Cape Barbas, in $22^{\circ} 19\frac{1}{2}'$ N., and $16^{\circ} 39'$ W. The bay formed by the cape is that which bears the name of *St. Cyprian*.*

The Bay of St. Cyprian, being open from N.E. to W.N.W. (*true*) is unsheltered from the prevailing wind on the coast. In consequence of this there is generally a heavy sea in it; and the anchorage, although on a bottom of sand and mud, in ten to twenty fathoms, offers very little security, and should be resorted to only in cases of necessity. The abundance of fish in this bay frequently attracts the fishermen from the Canaries, who, seduced by the hope of being quickly laden, and the appearance of a moderate breeze, anchor too near the bottom of it. In this situation, if the wind freshens up, being equally incapable of beating out with their crazy vessels, or with their ground-tackle of riding out the heavy sea which sets in, they are sure to drive and be thrown up on the beach, where their crews frequently lose their property and lives, or, which is not less deplorable, are robbed and detained in slavery by the Arabs. Here the magnetic variation was observed to be $19^{\circ} 28'$ W. in March, 1817.

FROM CAPE BARBAS the coast trends nearly W.S.W. [$S.W.$] three leagues. It is formed almost by one uninterrupted cliff, about eighty feet high, at the foot of which the sea breaks violently. At one mile from the beach, there are from nine to twelve fathoms, and at two miles, as much as seventeen fathoms, with a bottom of muddy sand, or sand and broken shells. The coast then declines into white sandy downs, studded here and there with cliffs. At about three leagues from this, it forms rather a remarkable little bay, with a shore of white sand. The mouth of this bay is barred, at about three miles from its bottom, by a flat of banks and reefs, on which there is very little water. These reefs serve as a foundation for an islet, called that of *Pedra da Gall*, and another small islet, which M. Roussin has named *Virginia*. These islets are merely rocks, of a nature similar to that

* The *Bay of Tribulation* of M. Roussin. But we consider a change in the name quite unnecessary, and, therefore, improper.

of the coast. The first, which is rather higher on the northern than on the southern side, is about half a mile in circumference. The latter, or southern one, is three times that size, and has some sandy patches. It is also three thousand fathoms from the coast, and about a league *S. by W. (true)* of Pedra da Gall. They are connected together by a chain of flats, which stretches 400 fathoms to the S.W., and 1000 fathoms to the N.E. of Pedra da Gall. At one mile westward from these islets may be found eighteen fathoms of water, with muddy sand. The depth increases to the southward, and the bottom becomes harder.

From Pedra da Gall to Cape Blanco, the distance is twenty-nine leagues and a half. The coast in this extent is nearly straight, and moderately high; its *true* direction is *S. 15° W.*, and it presents only a few indentations of a trifling depth. It is one continued down, the whiteness of which becomes more vivid on approaching to the southward. In some places it presents peaked cliffs, in others there is a gentle descent toward the sea, and the whole is devoid of vegetation.

CAPE CORVOEIRO.—Having, says M. Roussin, in our way from the northward, reached the parallel of $21^{\circ} 50' N.$, after passing a sandy beach of about two leagues in extent, with few indentations, we find ourselves abreast of a moderately high cliff, whose irregular summit forms a striking contrast with the uniform smoothness of the adjoining coast. This cliff is five miles in length N.E. and S.W. [*N.N.E.* and *S.S.W.*], after which the downs again commence, having previously formed a small bay to the southward of the cliff. The most salient point of this cliff is **CAPE CORVOEIRO**; but it is not well defined, and is only remarkable from the breaks in the beach where it is situated. The strength of the current here is the same as on the whole coast, about nine-tenths of a mile per hour; but farther out to sea, it loses half that velocity. Between the islets and the coast, at the distance of half a mile from the latter, the depth is from six to nine fathoms, with a bottom of sand, sand and shells, or sand and rocks. At the distance of a mile from the coast, it varies from ten to twenty fathoms, with mud and sand. The muddy bottom prevails to the southward of Cape Corvoeiro, and all this coast is perfectly safe. At twenty-five leagues to the northward of Cape Blanco, we discovered from the mast-head, that the beach, along which we were running, was formed by a tongue of sand from two to three miles in breadth, beyond which we observed water. This is now called *Greyhound Bay*, and is situated to the eastward of Cape Blanco. From Cape Corvoeiro, the coast is formed of white and red sandy downs, assuming various shapes, alternately terminating at the water's edge in broken cliffs and low sandy beaches, on which there is a heavy surf.

CAPE BLANCO, in $20^{\circ} 47' N.$ and $17^{\circ} 4' W.$, is the southernmost face of a white cliff, about 150 feet high. It rises vertically from a gentle slope which extends from its base to the sea. With a point four miles to the northward it forms a bay, at the bottom of which is a beach of white sand, interspersed with masses of the cliffs. Through one of these masses, the sea has perforated a hole, which, in shape, much resembles an arch. The anchorage in the bay, as well as on the whole coast from Cape Corvoeiro, is good: a bottom of muddy sand prevails throughout, with a depth varying from nineteen to twelve fathoms. At one mile to the southward there are nine and twelve fathoms, and large vessels may anchor at this distance to the eastward, where they will be sheltered from the prevailing N.N.E. and N.W. winds.

The portion of coast terminated by Cape Blanco is a long promontory, which, projecting from the main, forms with it a bay of nearly eight leagues from North to South, and about six broad. The bottom in this bay is generally composed of soft mud, and there is a depth of water varying from forty to seventeen feet, reduced to the lowest springs. On the western side there is excellent anchorage for vessels of a middling class.

In a radius of eight or ten miles round Cape Blanco, and in Greyhound Bay, the currents are subjected to regular tides. The flood sets E.N.E., and the ebb W.S.W., the greatest velocity of either being from one to two miles per hour; but it attains this rate only when the wind blows with it. The greatest rise above the level of the lowest tide is ten feet, and it is high water, on the second day after full and change, at 0h. 15m.*

* "*The Tides about Cape Blanco* are irregular, and much influenced by the land near which they run. High water, at full and change, may be looked for about noon; the greatest rise, under every advantage of springs and winds, does not exceed six feet. Southward of the parallel of the cape the indraught has a velocity of 2.6 miles, and the off-set or ebb the same. Eastward of the meridian of the cape the tide bends northerly, and at three miles chord its velocity appears from S.W. to N.E., about $2\frac{1}{2}$, following the circular course into Greyhound Bay. North of the parallel of the cape the ebb sets North, and flood South; and, close in shore, the tide is considerably weaker than at three miles, where its greatest influence may be expected."—*Capt. Belcher.*

All this coast abounds with good fish, as cod, bream, soles, &c. On the little beach eastward of Cape Blanco, a single haul of the seine has produced a thousand pounds weight. The best kind of turtle, namely, the green kind, also abounds hereabout. According to the information obtained from the Canarian fishermen, who frequent the coast, a small quantity of drinkable water may be obtained by digging a little to the northward of Cape Blanco. This spot is occasionally visited by some Arabs, who possess a few muskets, and against whom it is necessary to guard. Here the magnetic variation, in March, 1817, was $18^{\circ} 9' W$.

In 1830, *Captain Edward Belcher*, in H.M.S. *Ætna*, by the mean of several observations, assigned to the extremity of Cape Blanco latitude $20^{\circ} 46' 26''$, longitude $17^{\circ} 4' 10''$, as shown in page 28. This gentleman has given a geological description of the cape and neighbouring country, which is inserted in the *Journal of the Royal Geographic Society*, (Vol. II. pp. 299-303,) and in which he particularly notices the practice of the Canarian fishers, in the vicinity of Greyhound Bay: the anchorage of these vessels, schooners, with their boats, is in a bay about three miles north from the cape, where they are quite sheltered from N.N.W. to S.S.E. Those of the fishermen whom Captain B. met with were courteous and communicative, and they stated that their usual fishing-ground is in 25 fathoms, where they take fish of from 8 to 60 lbs. each, and that their average daily work is about 3 cwt. in the boats. The schooners have polacca fore-masts; and, when fishing, they furl all the sails in one; their burthen is from 100 to 150 tons. The fish taken by the *Ætna* were porgy, mullet of several kinds, rock-cod, and red-snappers, probably called bream by former voyagers. Mussels and other shell-fish are very abundant at low water.

The summit of the Blanco peninsula is composed of lines of sand-hills and rocky eminences, just what one would expect to find if the sea were to quit its position, and show us the beds over which it flows. In every position, where a bush or rocky islet is prominent, there, on its southern side, you will surely find its sand-hill—a proof of the prevalent winds, as well as an admirable model of the formation of shoals, &c. under water, and pointing out most perfectly the ‘steep-to’ approaches to banks, past which rapid streams or currents flow, with their concomitant shallow tail, formed by dead water or eddies.

With the exception of these newly formed and forming sand-hills, the whole surface is covered, in a *most extraordinary manner*, with shells, of all dimensions, and of the species generally found in the bay.” These are loose, and some are more than 60 feet above the level of the sea!

The Spaniards affirm that there is no rainy season here, but strong northerly and north-easterly winds the whole year. In June and July they were North, N.N.E., and N.E. Highest temperature of air in the shade, 75° ; of the water, 76° .

BANK of ARGUIN, &c.—The bank of Arguin commences at four leagues to the southward of Cape Blanco. It is a great shelf of about 30 leagues in length, and reaches to the southward of Cape Mirik. The north point of it is in latitude $20^{\circ} 33' 12'' N.$, and longitude $10^{\circ} 56' 30'' W$. The coast between this point and Cape Blanco is replete with shoals. The most considerable one is that of the *Bayadere*, at a mile and five-tenths to the southward of the cape. There are only 20 feet of water on this shoal, and it occasionally breaks. Another lies W. $\frac{3}{4}$ N. [*W. by S.*] three miles from the cape; and a third at eight miles S.S.E. $\frac{1}{4}$ E. [*S.E.*] of it; on which, like the first, 20 feet of water have been found. The channel, leading to the anchorage, eastward of Cape Blanco, lies to the northward of these shoals.

The *Bank of Arguin* is a flat of sand, constantly increasing, of the same nature as the coast. The body of it is hard, and covered with broken shells. Its outer edge, which has been traced from numerous soundings, has been fixed at the depth of 8 fathoms, as no vessel can run within this limit without risk; and, at a very short distance to the eastward of this boundary, there are less than 4 fathoms. No particular part on the edge of this bank has been seen quite dry; but close to the breakers, which occur in many places, there are not more than 10 feet of water; and the shallows between them do not appear to have more.

Between the north point of the bank and its western extremity, situated in $20^{\circ} 6' 20'' N.$, and $17^{\circ} 7' 30'' W.$, on advancing from seaward, the soundings progressively decrease. At 10 leagues to the westward, from 40 fathoms they decrease to 8, with a very gentle ascent; but to the southward of this parallel the bottom becomes more uneven; and from the point where

where the Medusa was lost, (see p. 300,) in latitude $19^{\circ} 53' 42''$, and longitude $17^{\circ} 0' 35''$, a great irregularity takes place.

From the westernmost extremity, the edge of the bank trends S.S.E. [*S.E. $\frac{1}{4}$ S.*] and extends as far as Cape Mirik. The nature of the ground about the Bank of Arguin has a very remarkable characteristic, which may prove of great service to navigators. From the depth of 8 fathoms, which has been assigned as the limits of this bank, to that of 25, to seaward, including an extent of more than five leagues, the lead invariably brings up a mixture of sand and broken shells; and, in proportion to the proximity of the bank, the latter prevail. Beyond the depth of 25 fathoms, as far as that of 45 and 50, at eight or ten leagues to seaward, the bottom is entirely of white sand. Hence it is evident that, by soundings, and a rough observation for latitude, the distance from the Bank of Arguin may always be known. Should less than 25 fathoms be found, with a bottom of sand and broken shells, you will be less than five leagues from its edge; and in proportion as shells predominate in the soundings, you will be nearer to it, and should avoid getting to the eastward. Should you have more than 25 fathoms, with fine sand, you will be more than five leagues from it. To the northward of the parallel of 20° N., this may be particularly depended on; to the southward of that limit, it is subject to some exceptions; but as the bank then takes a direction S.S.E. [*S.E. $\frac{1}{4}$ S.*], it becomes no longer dangerous, if a ship is kept on a wind in 20 to 25 fathoms, and sounds frequently. Henceforth we may conclude (which all mariners must be convinced of,) that a strict attention to incessant sounding is so indispensable, as to need no further recommendation.

CURRENTS.—It has been already shown, in page 177, that the prevailing currents set from North to South along the whole coast. Along the edge of the Bank of Arguin, as far as its western extremity, this direction is constant; and in the rainy season, should any deviation be experienced, it may be relied on to happen very seldom. One proof of this may be adduced. On the 13th July, when the wreck of the Medusa was found by the brig Argus, after thirteen days' absence from the frigate, it was abreast of Portandik, at 15 leagues from the shore, a distance of 90 miles, and nearly on the meridian of the place where she was lost. It must, therefore, have driven at the rate of seven miles per day along the coast.

CAPE MIRIK is that point of the coast which terminates the Bay of Arguin on the south, being a very low sandy point, on which there is a small down.* It is surrounded by the southern part of the Bank of Arguin, and cannot be approached by large vessels, on the west, within three leagues, and on the S.W., within two. The magnetic variation, at the southern anchorage, in April, 1817, was found to be $18^{\circ} 49'$ W.

TANIT BAY.—The coast from Cape Mirik trends S.S.E. $\frac{1}{4}$ E. [*S.E.*] 10 leagues, it then forms a complete elbow, gradually trending S. $\frac{3}{4}$ W. [*S. by E.*] It is low, and presents a continued chain of small regular downs composed of white sand, and interspersed with small bushes. To the northward of the bay, formed by the bend of the coast, some downs may be observed which are rather higher, and more insulated than the rest. A few huts are seen near the beach, and in the dry season numerous parties of the thieving tribe assemble here to catch fish and dry their stock. Two large pieces of water may be seen between the high downs: but whether these be fresh or salt is unknown. The latter seems most probable. This bay bears the name of *Tanit*, and the north point of the down, at the bottom of it, as observed by Baron Roussin, is in $19^{\circ} 3' 48''$ N. and $16^{\circ} 12' 20''$ W.

ANGEL HILLOCKS.—From *Tanit Bay* the general direction of the coast is South [*S. by E. $\frac{3}{4}$ E.*] in an extent of 12 leagues. At the distance of four leagues from the termination of this bearing are some downs, which are rather higher than the rest of the beach, and with some bushes on their surface. The beach itself is formed by a very low flat of quick-sand. These downs are the *Angel Hillocks*, composed of sand, of which the summit is from 15 to 20 fathoms above the sea, and they constitute a useful land-mark. They are divided into two groupes: the summit of the northernmost, which is much smaller than the other, is studded with tufts of brushwood; while the southern, which is formed of eight or nine hummocks, is nearly destitute of it. The latter, which is the highest, stands in $18^{\circ} 29' 30''$ N., and $16^{\circ} 2'$ W. The coast, from these hillocks, gradually declines in height, and more so as it approaches to the southward, when it soon

* Captain Owen gives this down in $19^{\circ} 25'$ N. and $16^{\circ} 34'$ W. Baron Roussin as $19^{\circ} 22' 14''$ N. and $16^{\circ} 31' 21''$ W.

falls into a uniform line of sand, with occasionally a bush here and there, scarcely above the level of the sea.

ANGEL BANK.—No part of this coast, southward from Cape Mirik, should be approached within five miles, nor to a less depth than $6\frac{1}{2}$ fathoms. By attending to this rule, all dangers will be avoided, and, amongst others, a shoal which extends outward, three miles from the coast, abreast of the northern part of the Angel Hillocks, from which it derives its name. On this bank there are regular soundings on a bottom of sand, with sand and broken shells, affording anchorage in case of necessity. On receding from the beach, the depth increases; and, at the same distance from it, is greater than to the northward of the hillocks.

PORTANDIK.—At four leagues to the southward of the Angel Hillocks, on rather an elevated part of the coast, and a little within the beach, are two palm-trees, without branches, standing close together. The northernmost is the smaller of the two, and they are the only palms to be seen on the coast between this and Cape Boiador. They stand in latitude $18^{\circ} 18' 54''$ N., and Portandik is supposed to have existed at about one mile to the southward of this spot. Not a vestige now remains sufficient even to indicate to strangers the spot on which this little establishment once stood. From the two palm-trees the coast trends nearly S.S.W. [*South*], then to S.W. [*S.S.W.*] It is straight and low, interspersed with small bushes, and presents a continued sameness. In an extent of thirty-five leagues, there are only two downs of red sand, covered with brushwood, and discernible only at about two miles from the beach. One is in latitude $17^{\circ} 25' N.$, the other in $16^{\circ} 55' N.$ From the mast-head, some sheets of water at the foot of these downs may be seen. At two leagues to the southward of the latter, the interior of the country becomes a little clothed with brushwood, and occasionally presents some level plains, but the coast remains uniformly barren.

ENGLISH GUM TRADE.—The Dutch have the credit of being the first who introduced the Gum Arabic, commonly called Gum Senegal, into Europe, in the early part of the 17th century, when they carried on the fishery in the Bay of Arguin. The French merchants of Bordeaux and Nantes first brought it, however, into general repute, and decided its purity and superiority to the gums of the East. From 1760 to 1779, England possessed the Senegal, and the trade for the gum; and by the Treaty of Versailles, 1763, reserved to herself the exclusive possession of this commerce, which she protected and maintained. The English demolished the forts and establishments at Portandik and Arguin, which had been formed in 1724 by the old India Company of France, in order to bring the whole of the gum of the African forests into the River Senegal. In 1779 the French obtained re-possession of the Senegal; but, by the treaty of 1783, it was agreed that the English should have the liberty of carrying on the Gum-trade from the mouth of the *River St. John* (three leagues north-eastward of Cape Mirik) to the bay and port of *Portandik*, inclusively; provided that they should not form any *permanent* settlement, of what nature soever, in the River St. John, or the bay of Portandik. The treaty is still in force, as no alteration of it was made by the treaty of 1814; which merely stipulated the engagement of the English Government to restore to France, in full right and sovereignty, the possessions of Senegal and Goree. The transfer took place in 1816, when the English withdrew to their other settlements on the coast; leaving the gum-trade entirely in the hands of the merchants of Senegal, although they possessed an indisputable right to the trade from the Bay of Arguin to the Bay and Port of Portandik.

At the commencement of the year 1821, the British merchants of the Gambia obtained the support and assistance of the local government in the attempt to renew the gum-trade at Portandik, and revive that friendship and good-will which formerly subsisted between them and the Moors in Senegal. Commodore Sir George Collier was solicited to order a vessel of war for the protection of the trade, and to convey presents to the Chiefs of the Trazzarh or Tarassa Moors; and for this purpose his Majesty's gun-brig *Snapper*, commanded by Lieut. T. Evans, was selected, and proceeded on this important service. The trade has since revived, and was going on with the Moors in 1834, when it was unjustly interrupted by the government of Senegal: but this temporary check, although since repeated, will probably tend more to its increase than destruction.

PORTANDIK to the RIVER SENEGAL.—On the parallel of $16^{\circ} 33' 24''$, and at the termination of the 35 leagues of coast already described, we arrive at the huts of *Inguagher*, or the spot called by the French the *Marigot* or Lagoon of *Mosquitos*. This, in the rainy season, forms a mouth of the River Senegal, the banks of which are covered with

with mangroves. At the distance of two or three miles from the beach, regular soundings may be found, in from 7 to 13 fathoms, fine sand, occasionally mixed with mud, and affording safe anchorage between this and the palms of Portandik. To the southward the depth gradually increases.

The *Marigot of Mosquitos* is about twelve leagues to the northward of the Isle St. Louis, in the Senegal, and it communicates with the sea only when the rains have swollen the river. It then covers the bank at its entrance, which may be passed over by boats, but they must be prepared against the surf which is common to it, as well as the entrance of the Senegal. To the southward of this *Marigot*, the river is separated from the ocean by a strait tongue of sand, formed by small white downs, nearly bare, and gradually becoming lower toward the extremity. Within this tongue of sand, the stream of the Senegal washes a number of small islands which lie parallel to the coast, and on which a covering of thick bushes gives the country some appearance of fertility. They are known by the name of the *Antelope Islands*, *Griel Wood Island*, and *Thiong Island*. The last is at a very short distance to the northward of the Isle of St. Louis.

Griel Wood Island is distinguished by its bushes, among which are some trees higher than the rest, presenting a remarkable contrast to the barren desert of two hundred leagues which precedes it. Its distance from the Isle of St. Louis, in a straight line, is not more than five leagues and a half. Both to the northward and southward of *Griel Wood Isle*, the stream of the river may be distinctly seen from the mast-head, running between the isle and the beach, and it is the surest mark for discovering the landing-place to the northward of the bar.

A vessel may run along the coast, at the distance of two miles from the beach, in from 9 to 14 fathoms, over an excellent bottom of thick green mud.

SENEGAL.—On continuing your route to the southward, the French establishment of St. Louis, in the Senegal, will soon be seen. This place is remarkable for its white buildings, and a very high palm-tree which stands conspicuously close before the flag of the fort. The latter is in latitude $16^{\circ} 0' 48''$ N., and longitude $16^{\circ} 33' 6''$ W. The western bank of the Senegal is so narrow and low, abreast of the northern part of this Island, that the town appears to stand on the sea-shore, and it is only on nearing it, that the channel which separates them can be seen.

A little Moorish town, called *Gattandar*, consisting of huts on a sand-hill, stands upon the strand, opposite the town of St. Louis. It was built by the negroes engaged to open the communication in canoes with vessels arriving, and checks the sands, which are constantly in motion. On the S.W. part of the Island of St. Louis, is a down on which cannon are placed. From *Gattandar* the distance to the Bar of the Senegal is only two leagues. The anchorage off the mouth of the river may be taken in 7 to 14 fathoms, according to circumstances. This depth extends from two to four miles from the Bar.

The mouth of the Senegal presents nothing remarkable when seen from the northward. The breakers which prevail on the whole coast as far as *Point Barbary*, the northern point of the entrance, prevent those on the bar from being distinguished, and vessels may run past without seeing them, if they keep at too great a distance from the shore. From *Gattandar* you may run at the distance of a mile from the beach without danger, which will enable you to observe the smallest alteration in the coast. A small post in the centre of the river, abreast of the *English Islet*, where there is a signal post, and a guard-house on *Babagne Island*, at a short distance to the eastward of the bar, will then be passed in succession. This guard-house is a remarkable small square house, near which there is a second signal-staff; and a vessel may anchor when this guard-house bears E. $\frac{1}{2}$ S. [*E. by N.*] As the winds generally blow from the northward, in consequence of the facility for communication with the shore, it is advisable to anchor rather to the northward than to the southward of the Bar.

The bar of the Senegal is not stationary. The western bank of the river, from the Isle of St. Louis, is so low that high tides completely cover it, and, at times, force open a new channel. That now described was formed in February, 1815. Its northern point is in latitude $15^{\circ} 55' 18''$ N., and longitude $16^{\circ} 32' 40''$ W., and it increases gradually to the southward. Here the magnetic variation, in May, 1817, was $17^{\circ} 32'$ W.

The dangers attending the bar of the Senegal are well known to be of no trifling nature. In the rainy season, and even in March, when the river, increased by the rains, discharges a greater body of water into the sea, the bar is frequently impracticable even by decked boats.

boats. The waves caused by the impetuosity of the river-water meeting with that of the ocean, are very considerable, and succeed each other so rapidly that it is impossible to find a *smooth*. It is not uncommon in these cases to see breakers at the distance of a mile from the bar, and in eight fathoms of water. From the month of April to the end of September, the bar may generally be crossed by decked boats, and sometimes even by canoes, but it is advisable that they should be steered by natives.

Vessels drawing ten feet of water, cannot cross the bar. Those of a moderate size only should, therefore, be employed in the commercial navigation of these parts, otherwise the loading and unloading, when necessary to employ lighters, becomes very expensive. Inside the mouth, the depth is from six to eight fathoms; and with the assistance of the tide and a pilot, a vessel may very easily beat up to the Isle of St. Louis.

CURRENTS.—It has already been said that the general and almost constant direction of the current, is along the coast from North to South, as far as the mouth of the Senegal. Abreast of this opening, and in a space of several miles to seaward, the river tides affect the general uniformity of this current. The flood and ebb tides are alternately felt at the bar and anchorage; they have no settled direction, but may be considered as setting about N.W. and S.E.; and are frequently so strong, as to make the vessels tend at the anchorage, or at least to lay with their broadsides to the wind, in the strongest breezes. This anchorage is rendered very inconvenient by the short sea which is always upon it. See page 148.

The preceding descriptions are chiefly those of the Baron Roussin. The following, from our former edition, may, also, be acceptable.

From *Santa Cruz, Tenerife*, to the River Senegal, the *true* and safe course is S.S.W. to latitude $18^{\circ} 30'$, before a ship hauls to the eastward. This is in order to avoid being set by the current too far to the eastward, or on the banks of Arguin, &c. From the above-mentioned latitude haul to the south-eastward, so as to make the land in about $16^{\circ} 15'$, when you will probably see the trees already noticed, which are the most remarkable on this coast.

If standing in for the land by night, heave a cast of the lead every hour, as you fall into soundings all at once, 50 fathoms close to the edge of the bank, at the distance shown by the Chart, or about 8 leagues from shore, and thence shoaling to 8 fathoms at a mile and a half from it.

The Bar of the Senegal is most easily passed in the months of July, August, September, and October; but it is very rarely quite calm. On the contrary, the sea frequently breaks against it violently. The waves, which strike against it, are always united in threes, or leashes. For example, when the sea is but slightly agitated one may perceive three waves, perfectly distinct, approach and break against the bar, immediately after each other; and these three waves appear to be, as it were, connected; for there is often a considerable interval of time between the attack of the first three waves and the approach of the succeeding trio.

During the prevalence of rough weather, this series of assault, by united waves, incessantly prevails; but then these attacks follow each other so rapidly, that the time between them is no longer perceptible. The sailors call the interval between the two assaults, when tolerably long, a *set-off*, because then the bar experiences a slight degree of rest, during which time it may often be passed: but frequently the violence of the waves is so great, and squalls succeed each other so rapidly, that there is no longer any interval between them; and, consequently, no *set-off*.

Mons. *Golberry*, to whom we are indebted for this description, adds, "The force and rapidity with which the waves of the same squall, and even the squalls themselves, follow each other, depend upon the general state of the wind and sea; but I have often remarked the latter to be calm at a distance, while the wind was blowing very gently, and, nevertheless, the waves continued to break with violence over the bar. I have attributed this to some convulsion of the sea at a distance, the effects of which may have extended to the extremity of this bay. After the cause of this considerable motion has ceased, the surface of the sea soon becomes calm; yet the great mass of the element preserves, for a long time, an oscillating undulation in the open sea, the effects of which are very perceptible near shore.

"When the waves from the offing proceed toward, and break against, the bar, the passage is always difficult, sometimes dangerous, and often impracticable, at least without incurring the risk of destruction.

"The waves have attained their full violence when a second or third will pass over a shallow or small vessel, fill it, cause it to sink, or make it run aground; because the last two waves break in a semi-circular form; the third, in particular, produces this effect, and the cause of the expansion may readily be conceived.

"The first wave which arrives does not form the semi-circle, because it meets with no obstacle from the return of the particles of that which preceded it; and, when the attacks are separated by an interval, the first wave has time to disperse itself; the second forms an arch, because it meets with the divisions of the former, which are returning toward the sea, and which, forming an impediment, force it to rise; but the third wave, which at once experiences the combined obstacles of the returning waters of the first and second, can force its way only by a sudden inflation; and, as its rapidity is occasioned by a very strong impetus, it immediately rises and forms an arch, or semi-circle, the height of which is in proportion to the rapidity of the wave at the time of its contact.

"It is, therefore, in general, this third wave which proves most destructive: the arch which it forms is so great in its diameter, as to cover a vessel completely in every direction; and it has often happened that barks have been raised, by this impetus, perpendicularly, as it were, on the end of the keel. This effect of the power of the waves was unfortunately experienced by a cutter belonging to the corvette *Rossignol*, commanded by M. de Corneillan, a lieutenant. The vessel had entered the river, having nearly reached the middle of the bar, which this officer thought practicable, when the third part of one of these bodies of water struck it on the stern, raised the hull perpendicularly, and placed it on the extremity of its keel: it remained for an instant in equilibrio, and then overturned.

"During my residence in Africa, there were wrecked, on the bar of Senegal, four ships and twenty-two shallops, by which a hundred and nineteen men were drowned."

On passing by sea within cannon-shot of the Isle of Senegal, it affords a very agreeable prospect. Fort St. Louis forms the principal object in this perspective. To its right and left extend the two parts of the town, the streets of which are well arranged; and, in general, composed of thatched cottages or huts, interspersed with some stone houses, covered, according to the custom of this part of Africa, with flat roofs.

The woods which line the east bank of the river, appear, at this distance, to belong to the isle, and give it a cheerful and rural aspect; but this illusion disappears on a nearer approach; for no place can be more arid, parched, or deprived of vegetation, than the Isle of St. Louis, the soil of which is nothing but a fine shifting sand. Notwithstanding this, the population amounts to about 5000 persons. The water of the isle is brackish and unwholesome.

For a copious description of the gum trade, see the *Travels of M. Golberry*, of which a translation has been published, affording most valuable and interesting details relative to all the country of Senegambia, &c.

The Baron Roussin continues his description as follows:

WINDS.—The winds are not at all dangerous in the navigation of the coasts of the Senegal. They blow nearly along the coast from the N.E. and N.W. during the greater part of the year; and as, in the rainy season, the squalls always come from the S.E., and the winds which succeed them are very weak, when they once pass the S.W. quarter, getting under way is always easy. Those vessels in the road which cannot depend on their ground-tackle, may return to it when the squall is over. At Senegal, water, wood, beef, mutton, and poultry, may be had of a moderate quality, and not dear.

SENEGAL to CAPE VERDE.—If a straight line were drawn from the anchorage at the bar of the Senegal, to the outer rocks of the *Almadies*, on the western point of Cape Verde, its direction would be nearly S.W. by W. [$S. 40^{\circ} W.$] and its length thirty-one leagues. The arc described by the intervening coast, and subtended by this chord, bends so little, that it would not exceed the whole length by more than four leagues, and its greatest depth would be thirteen miles.

The coast, as far as two or three leagues to the southward of the Senegal, is just as low as that to the northward, and resembles it very much; it afterward becomes rather higher, but is uniform in general appearance. It is composed of a chain of white sandy downs, scattered over with brushwood, amongst which a small cluster of trees may be distinguished. It generally presents two well-defined plains. The first is that next to the sea, formed of white sandy downs, on which there appears some verdure. The second, which is considerably

ably higher than the first, commences at about two miles in the interior, and is formed by downs of a greyish colour, which are covered with bushes.

In running for the Senegal, from the southward, the mouth of the river is more easily distinguished than when approaching from the northward, from its appearing more open. At the distance of eight leagues from the mouth, and on the parallel of $15^{\circ} 26' N.$, a large red sandy down may be observed entirely bare, which, to those ignorant of their latitude, may serve to indicate their distance to the southward of the bar. From this down, southward, the coast presents nothing remarkable as far as the *Little Paps*, of which the northern is in latitude $14^{\circ} 56' 24'' N.$, and longitude $17^{\circ} 6' 10'' W.$

The *Little Paps* are the two highest downs between the Senegal and the *Paps of Cape Verde*. They are situated on the beach, and are easily known by a slight undulation of their summit, and three or four other small hills adjoining them to the southward. They are visible at the distance of four or five leagues. The *Bay of Yof* commences from this point.

The *Little Paps* bear E.N.E. $\frac{3}{4}$ E. [$N. 59^{\circ} E.$] from those on *Cape Verde*, at the distance of nine leagues. When running this distance, in fine clear weather, both are frequently seen at once. The latter may be seen at the distance of seven or eight leagues. From about eight leagues to the eastward of *Cape Verde*, the coast rises very much, and becomes more wooded. The country about the cape is covered with trees, amongst which there are several of remarkable height. All this coast may be approached within a very short distance. Within two miles to the northward of the village of *Yof*, situated near an islet of that name, there are 55 fathoms of water on a bottom of mud and sand.

CAPE VERDE is the westernmost point of Africa; it is the extremity of a peninsula formed on the north by the *Bay of Yof*, and on the south by the bay in which the isle of *Goree* is situated, and is composed of moderately high land. To the westward, as far as the two *Paps of Cape Verde*, as aforesaid, it becomes higher, and, on the southern side of these two *Paps*, the coast next the sea becomes nearly perpendicular. This point is usually taken for *Cape Verde*; it is not the westernmost part of the peninsula, but it is the highest. Its latitude is $14^{\circ} 43' 5''$ and longitude $17^{\circ} 33' 7''$. *Cape Verde*, as seen from the northward, terminates in very low land, on which are some unconnected hillocks, which, at a distance, may be taken for islets. The extreme point extends a thousand fathoms still farther east, in a flat of blackish rocks, awash with the water's edge, and which, in two or three places, rise from eight to ten feet above the level of the sea. This rocky flat is called the *Almadies*, and the point which joins it, *Almadia Point*.

The sea on the *Almadies* breaks incessantly. Amongst the rocks are some smooth spots appearing like channels fit for boats. The flat may be coasted at the distance of a mile; there being, on the west, 35 fathoms of water; the bottom is of broken shells. Hence to the northward, in an extent of three miles, the depth increases to 80 fathoms; bottom of mud and sand. To the S.E. the depth is not so much; in running along these breakers and the coast, to a distance of two miles in that direction, which will extend to the meridian of the *Paps*, the depth varies from 25 to 30 fathoms, the bottom sand and shells, or sand and rock. The depth then continues to decrease to the E.S.E. The highest and westernmost rock of the *Almadies*, which appears from a distance in the shape of a die, is in lat. $14^{\circ} 44' 29''$, and long. $17^{\circ} 35' 29''$, as shown in the table, page 28.

CURRENTS.—The prevailing currents between the Senegal and *Cape Verde* follow the direction of the coast, in the same manner as those to the northward; and the idea of a current setting violently into the *Bay of Yof*, as formerly represented, is altogether false. The sea on this part of the coast is not particularly heavy nor dangerous; the smallest coasters of the Senegal and *Goree*, expose themselves to it with impunity every day.

Southward, from the Senegal as far as the parallel of $15^{\circ} 20'$, including an extent of more than twelve leagues, at two or three miles from the coast, the bottom is excellent, being of pure mud, with a depth varying from twelve to thirty fathoms. From this parallel, to the southward, doubtless the depth increases considerably. At two leagues to the westward of the *Little Paps*, for instance, there are from 64 to 70 fathoms of water. The muddy bottom continues here, and is so soft that the lead sinks deep into it, and the anchor alone would hold any vessel obliged to come to in consequence of calm. It is only in these cases that anchoring becomes necessary; if there is wind from either quarter, the formation

formation of the coast will always allow a favourable board to any vessel well found and well managed.

CAPE VERDE to GOREE.—From Almadia Point to Cape Manoel, the coast trends S.S.E. $\frac{1}{2}$ E. [S.E.] in a distance of about three leagues. In this extent it is high, covered with trees, and generally terminates at the sea-side in basaltic cliffs or sandy rocks. In some places only the cliff slopes toward the interior, and forms small bays with beaches of white sand.

At two thousand fathoms N.W. by W. $\frac{1}{2}$ W. [W. by N.] off Cape Manoel, and at half that distance from the coast, there is a group of rocky islets, called the *Magdalen Isles*, of which there are two principal ones. They are perfectly barren; even the largest, in the crevices of which were formerly some *baobabs*,* is nothing but a bare rock of a reddish colour mixed with basalt, and perfectly destitute of any vegetation. The shape of this islet, is that of a crescent open to the westward, and its greatest extent is nearly north and south. On the north side it has a gap, forming a very small creek, which affords a landing. The other rocks are to the south-eastward of the principal islet, separated by a space of one thousand fathoms, in which there is a depth of from four to six fathoms. The sea breaks with violence on all these rocks.

The space between the Magdalen Islands and the Main seems to offer a safe channel; but it should not be attempted by a stranger. In coasting the shore, from the Almadies to the Magdalen Islands, the soundings vary from thirty-four to nineteen fathoms. These islands may be approached on the southern side within a hundred fathoms.

Cape Manoel is high, formed of columns of basalt, and covered with very thick brush-wood; at the distance of a pistol-shot from it, to the southward, there is a depth of eight fathoms; and at a hundred fathoms to the north-westward of its extreme point, close to the beach, is a small insulated rock. In doubling Cape Manoel the extensive bay is opened, which is formed by this Cape and Cape Naze, which may be called the *Bay of Goree*. At the distance of 2100 fathoms from Cape Manoel, E. $\frac{3}{4}$ N. [N. 65° E.] lies the Island *Goree*, and a vessel intending to anchor must steer for it, and may approach on the south side within two musket shots.

GOREE.—**BAY of GOREE.**—*Goree Isle* is merely a rock, about 400 fathoms in its greatest length, from N. $\frac{1}{2}$ E. to S. $\frac{1}{2}$ W. [N. by W. to S. by E.] and 167 fathoms in breadth. It is a volcanic production, composed of basalt and sand, of the same description as the Magdalen Islands and Cape Manoel, from which it seems to have been separated. The southern part, which is about 500 feet above the level of the sea, is the highest, and like a round mountain, may be seen at the distance of five or six leagues. The rest of the island is very low, and the north point is distinguished only by its batteries and private buildings. The landing-place is on the N.E. side of the island, between the point and the back of the mountain, to the southward, in a small sandy bay.†

Goree contributes nothing toward either the subsistence or comfort of its inhabitants. Its two springs, situated at the foot of a rock, on its southern part, hardly suffice for the consumption of two families, and the inhabitants are therefore obliged to get their supplies of water, wood, and all kinds of food, from the Main.

The roadstead is to the N.E. of the island. This roadstead, which is sheltered from all winds from S.S.W. to E.N.E. (by the North,) is perfectly safe during eight months of the year; that is, from the first of November to the first of July: but during the rainy season, the squalls from the S.E. are dangerous. The best anchorage for large vessels, in either season, is at the distance of 800 fathoms from the landing-place, with Cape Manoel bearing W.S.W. $\frac{1}{4}$ W. [S. 52° W.] a sail's breadth open of the north point of the island. At this spot there is a bottom of thick clayish mud, with a depth of 12 $\frac{1}{2}$ fathoms, and it is convenient to weigh from, with the wind from any quarter.

To fetch the anchorage from Cape Verde, in the fine season, when the winds are from N.E. to N.W., it is necessary to run close by Cape Manoel and the south point of Goree;

* The *Baobab* is a species of very large tree, of a fine green colour, but which does not keep its verdure all the year round. From the trees of this sort on Cape Verde that cape derived its name.

† Mr. Finlaison has said that, ships sailing from the Cape Verde Islands, and bound to Goree, will strike soundings in 60 fathoms, fine sand, at 80 miles off.—EDIT.

keeping by the wind on the larboard tack, and sounding until in eight or ten fathoms. When within a mile of the land, tack and beat up to the anchorage.

The above position, assigned for the anchorage of this island, possesses one very great advantage in the tornado season; which is, that if the ground-tackle cannot be depended on, a vessel may run before the squall and even be sheltered for a short time. For this purpose it will be necessary to veer to the end of the cable before the squall comes on, as its violence may not allow of a vessel being managed with the expertness requisite on such an occasion. She should then steer so as to round the north point of the island at a convenient distance, and when to the westward of this point, whatever may be the violence of the squall (which is always from the S.E.), the island will afford sufficient shelter to enable her to keep on the larboard tack until abreast of the south point. Having reached thus far, she will be in a favourable position for doubling Cape Manoel, as by bringing it to bear W. $\frac{1}{2}$ S. [S. 65° W.] she may then steer nearly four points free. All the channel between Goree and the peninsula of Cape Verde is perfectly safe, having in it from 5 to 13 fathoms of water, and the shores may be approached within the distance of 200 fathoms. A vessel intending to remain any time at the anchorage, should moor N.E. and S.W., as the two cables will then bear an equal strain in the heaviest of the squalls. Magnetic variation, in June, 1817, 17° 30' W.

The watering-place at Goree, and the Resources which this Anchorage offers.—The watering-place of Goree, used by vessels which frequent this island, is about three thousand fathoms N.N.W. of the anchorage. It consists of several pits dug in the sand on the sea-side, near a marsh, and close to a negro village called *Han*. The water is neither agreeable nor wholesome, and should not be drank until it has been filtered, acidulated, or cleansed by red hot shot being put into it. The cove in which it is situate is exceedingly well stocked with fish, and hauling the seine will be attended with success, by any number of vessels touching here. Fire-wood is purchased from the negroes of *Ducar*, a little more to the west, at the rate of about twenty shillings the chord. Ballast may be procured at the foot of the point of that name. Small bullocks may be purchased from the neighbouring coast, for six to eight dollars each.

The whole coast, from Cape Manoel to Cape Naze, which forms Goree Bay, may be run along at the distance of two miles. One bank only lies at 800 fathoms E.S.E. $\frac{1}{2}$ E. [E. 3° N.] from Cape Belair,* having soundings which vary from 16 feet to 12 fathoms, with a bottom of muddy sand, or sand and shells, as far as the parallel of Cape Naze.

From the Bay of Han, northward of Goree, the coast rises a little at some miles in the interior, but it is exceedingly low at the sea-side, where it presents nothing but a white sandy strand. We again perceive the little downs, the chain of which joins the Paps of Cape Verde, and which we ran along in going round the Bay of Yof. These downs rise progressively to the south-eastward, and are covered with trees as far as Cape Naze. This cape is terminated by cliffs of about 200 fathoms in height, the woody summit of which may be seen, in fine weather, at a distance of seven or eight leagues. In running along the coast toward Cape Naze, we pass successively several negro villages of the kingdoms of Cayor and Baol, belonging to Damel. The most considerable of these villages is *Rufisk*, on the eastern side of Goree Bay; then follow the anchorages of *Barnier*, *Red Cape*, *Yongop*, &c. all of which points are frequented by coasters from Goree, who trade for stock; they offer nothing interesting. The highest part of Cape Naze is in 14° 31' 30" N. and longitude 17° 8' 25" W."—(*Roussin*.)

There are some rocks, westward of *Rufisk*, stretching about a gun-shot into the sea, which may be avoided by keeping half a mile from the shore. To the West and W.N.W. of Cape Naze is good anchorage, in 4 and 5 fathoms, fine sand; but to the South and S.W. of the cape the bottom, generally, is not good.

In the night-time, you must proceed in 17 fathoms, having sometimes recourse to the lead; the land, even in the night, will direct you sufficiently to avoid the rocks. In the season of the tornadoes, the road of *Rufisk* is not good; but in the summer, you may safely lie there in 6 or 7 fathoms, close to the shore, if agreeable.

About 3 $\frac{1}{2}$ miles S.E. of the Red Cape lies *Cape Naze*, with a small bay between; from

* This is, we presume, the *Cape Bernard* of the charts, lying to the northward of Goree.—
EDIT.

the latter the coast extends to the S.E. $\frac{3}{4}$ S. [*S.E. $\frac{1}{2}$ E.*] about $4\frac{1}{2}$ leagues, as far as *Portudal*, formerly a French factory; and then 5 leagues S. by E. $\frac{1}{4}$ E. [*S.S.E. $\frac{1}{2}$ E.*] to *Cape Serene*; between this cape and *Portudal*, two leagues off the coast, and parallel to it, lies *Amboroo Bank*, on the south tail of which you find only $1\frac{1}{2}$ fathom. Ships that come from the westward must be cautious of this shoal; the ground is very hard upon it, and close to it is a depth of 5 fathoms.

To the S.E. of *Cape Naze* the land declines in height, and the downs are partially covered with bushes. The point near a little river, the *Soman*, is thus covered, and the country hereabout appears to be clothed with trees.

The village of *Portudal* consists of a number of huts on the shore. The coasters of *Goree* frequent this place. All the coast in the vicinity abounds in trees; and at two miles to the southward of the village is a small wood, very remarkable from its trees being much higher than the rest, and which therefore serve as a mark for the coast.*

The Road of *Portudal* is far from being good, and is fit for small vessels only; they lie close to the shore, athwart of the little houses between the cliffs. All the coast near *Portudal* is bordered with rocks, and must not be approached too near.

Three leagues S. by E. $\frac{1}{4}$ E. [*E.S.E. $\frac{1}{2}$ E.*] from *Cape Serene*, lies *Joal* or *Yoal*, standing on the north bank of a river of the same name, from which a shoal, with only $2\frac{1}{2}$ fathoms of water upon it, projects into the sea. The road of *Joal* is not much better than those we have just mentioned; the entrance of the river, between *Joal Point* and the point to the South of it, which they called *Palmarin Point*, is 3 miles broad, with a depth of 3 fathoms of water in mid-channel.

From *Palmarin Point* to the northernmost of the *Birds' Islands*, the coast extends S. by E. [*S.S.E. $\frac{1}{2}$ E.*] 8 leagues; and, from the mouth of the *Salum River*, which lies 4 leagues south-eastward of the point, to the *Birds' Islands*, the shore is bordered with a sand, named the *Red Bank*, that stretches 4 miles into the sea, and close to which are 4 fathoms of water. The *Birds' Islands*, four in number, and very small, lie on this Bank.

From *Palmarin Point* to the pitch of *Cape St. Mary*, the distance is 11 leagues, South. [*S. by E. $\frac{1}{4}$ E.*] The entrance of the *Gambia* lies between the pitch of that cape and the low islets called the *Birds' Isles*.

In sailing off the coast between *Cape Verde* and the *Gambia*, shipping must proceed with caution, as the *Amboroo Bank*, the shoals of *Joal*, and the banks in the vicinage of the *River Salum*, are dangerous, being very shoal.

RIVER GAMBIA.—Between the parallels of $13^{\circ} 30'$ and $13^{\circ} 40'$, in an extent of ten miles, is the estuary or mouth of the great river *GAMBIA*: it is bounded on the south side by a point named *Cape St. Mary*, the situation of which is latitude $13^{\circ} 30' 12''$, longitude $16^{\circ} 41' 24''$. On a point six miles S.E. by E. [*E.S.E. $\frac{1}{2}$ E.*] from this is the British settlement and new town of *BATHURST*.

Of this river *Captain Belcher* says, "The *Gambia*, considered in a mercantile point of view, and as regards supplies, appears to offer more decided advantages than any of our possessions on the coast of *Africa*; and may, indeed, be said to be the only point where any thing approaching to trade can be satisfactorily pursued. Even in its present state it is by far the most healthy part of the coast; and, had a portion of the liberality of government to *Sierra Leone* been extended to *Bathurst* and its dependencies, I feel satisfied that, long ere this, it would have acquired that character which eventually, with infinite labour, it will establish for itself from its own resources." The constitutions of the residents appear to be as sound as in any part of the world, and the strongest has been here thirty years without visiting *Europe*.

"The trade of the *Gambia* I also consider more likely to be speedily improved than that of any other point of this coast. The merchants have formed themselves into a company, with £6000. capital, to examine and further their interests on the banks of the river

* A more particular detail of this coast, and of all the shore between *Cape Naze* and *Cape Roxo*, by *M. le Predour*, (extracted from the '*Annales Maritimes*') was published at Paris, in 1828. To the description is annexed a copious table of the positions of places, as determined in 1826 and 1827, on board the frigate *la Flore* and goelette *la Dorade*, under the orders of *Capt. Massieu de Clercal*, which may be advantageously compared with more recent observations.

above *Pisanea*; and at the period of our departure (June, 1831,) were just setting forth on their first expedition.*

But it is to be regretted that, at Bathurst, the only fresh water to be had is from private wells; but, by close work in the dry season, as much as five tons a day may be obtained. Wood may be had at the beach, well dried, in convenient lengths for stowage, at a dollar and a half or 6s. sterling per chord.

CAPE ST. MARY is readily known by its making like a plain; low by the sea-side, with an acclivity toward the interior. It has some trees and one house upon it.

The narrowest part of the mouth of the Gambia is between the town of *Bathurst* and *Barra Point*, to the N.E., the distance between being only $2\frac{1}{4}$ miles.

From Bathurst Point, the Banyan or St. Mary's Shoal, a dangerous rocky shelf, extends 5 miles N. by W. $\frac{1}{4}$ W. [N.N.W. $\frac{3}{4}$ W.] It is even with the water, on the ebb. At a mile to the N.E. of this is a bank called the *Middle Ground*; and, at three-quarters of a mile northward of the latter, is a smaller one, the *African Knoll*. There are from 4 to 6 fathoms of water between these banks; but the best way in is to pass to the northward of the whole, keeping over toward the Red Bank and the Bank extending from the Barra or Eastern shore, according to the following directions.

"It is strictly to be recommended that vessels, bound to the Gambia, should get into the latitude of $13^{\circ} 40'$, or 4 or 5 miles to the southward of it: then, making a due East course, keeping their lead going, until in 5 fathoms, when you may anchor, and engage a pilot. But, should you be desirous of proceeding up, you may follow the sounding depths of the chart; remembering that, on the southern side of the channel the ground is hard; but on the north and east sides the lead sticks in, the bottom being of soft mud. The anchorage is off the town of Bathurst, with any part of it bearing about west, three quarters to half a mile off; the depths being 16, 14, and 12, fathoms. Small vessels may lie closer in, where there are 8 and 7 fathoms. The ground is good; the tides strong: but it is, altogether, a fine harbour."—*Lieut. G. L. Harries, R.N.*

The direct course, from 5 fathoms off Bird Island Shoal, to within the African Knoll, off the edge of the Red Bank, is S.E. [S.E. by E. $\frac{1}{4}$ E.] 5 miles, where there is, in the main channel, 6 and 7 fathoms. From the last spot to the anchorage off Bathurst, the course and distance, in a fair working channel, is S. $\frac{1}{4}$ W. [S. by E. $\frac{1}{4}$ E.] 7 miles.

When advancing to the Gambia, from the northward, you ought not to approach the river nearer than in 7 or 6 fathoms, before Cape St. Mary comes in sight. It may be advisable for a stranger not to proceed farther than in 5 fathoms without a pilot, unless the vessel draws less than 12 feet of water. Those leaving Goree, when bound to the Gambia, may steer about S. by E., keeping their lead constantly going, and approaching the coast no nearer than in 7 fathoms. When near the entrance of the Gambia, the ground will generally be found an ozy sand; but, near the cape, sometimes sand and sometimes red shells will be found. The ebb in the river runs very strongly, nearly 8 hours, but the flood is not so strong. Spring-tides are very rapid.

Having approached within one mile of Barra Point, from which a small spit stretches off to about a quarter of a mile, keep over for mid-channel between that point and Banyan or Bathurst Point. You have 8, 9, 10, and 12, fathoms between the two points, and good anchorage in 9 fathoms of water, muddy ground, with Barra Point bearing N.E. by N., and Banyan Point N.W.

The tide of flood sets on Barra Point, and the ebb directly on the Middle; be therefore very cautious during calms on an ebb tide.†

From Barra Point to Dog Island Point, on the same side of the river, the bearing and

* It is to be noticed that these are merely extracts from Captain Belcher's observations. Among the various exports of 1830, enumerated by this gentleman, are 242 tons of yellow bees' wax, valued at £100. per ton; 502 loads of African teak, £3. 10s. 6d. per load; 14,625 lb. ivory, 3s. 6d. per lb.; 76,471 hides; 500 oz. African gold; 3443 gallons of palm oil; 1140 country cloths and paguis; 1476 lb. arrilla. See *Geog. Journal*, Vol. II. page 296.

† At the Gambia, in the season of the Harmattan, the rainy season had just terminated on the 9th of December. Upon this occasion the colours are hoisted and a gun is fired. On a second visit in May and June, 1831, the end of the dry season, symptoms of approaching rains, with squalls.—*Capt. Belcher.*

distance are South [*S. by E. $\frac{1}{2}$ E.*] 8 miles. The coast between forms a deep and shoal bay, and the flats extend from it into the middle of the river. From Dog Island Point and Reef the coast takes a sudden turn to the S.E. and E.S.E. and it trends from Dog-Island Point to *Lemaine* or *Lemon Point*, S.E. $\frac{3}{4}$ E. [*E.S.E. $\frac{1}{4}$ E.*] two leagues. On this shore, at half a league more eastward, is the French settlement at *Albreda*, and at half a mile farther is the English one named *Jillifree*. One mile south-eastward from *Jillifree*, on an islet in the river, is *Fort James*.

To go up to *James Fort*, which is 17 miles above Bathurst, you steer in mid-channel two leagues, with the town of Bathurst N. $\frac{3}{4}$ W. [*N.N.W. $\frac{1}{4}$ W.*] This leads to a fair offing from Dog Island Point. The course hence, in the fairway, to abreast of *Lemaine Point*, is S.E. $\frac{1}{2}$ E. [*E.S.E.*] $6\frac{1}{2}$ miles; and thence to *Fort James* E.S.E. $\frac{1}{2}$ E. [*East*] $3\frac{1}{2}$ miles.

In order to avoid the shelf which extends from the Banyan or western shore, approach no nearer to that shore, in turning, than in 5 fathoms; nor near the Barra side, when above Dog Island Point, than in 4 fathoms; but if near that point, than in 6 fathoms. *Lemaine Point* should have a berth of a mile, as some shoals stretch from it. You may haul in and anchor before *Albreda* in 4 fathoms, half a mile from it, the ground shoaling gradually to within a cable's length of the shore.

After giving *Lemaine Point* a berth, do not haul for the Barra shore, till you are abreast of *Albreda*, for the flat continues to the eastward of that point to a considerable distance.

Under Admiralty orders, in 1826, the River Gambia, to the distance of more than 190 miles from its entrance, was surveyed by Capt. *Richard Owen*, with his assistants Messrs. Tudor and Mercer. This valuable survey exhibits the depths of water all the way up to *Pisanea*, where there remain the ruins of a factory, and where the tide, in the dry season, rises three feet. It appears from the survey, that, at three miles above *James Fort*, this noble river is nearly $2\frac{1}{2}$ miles in breadth. Here it takes a north-easterly direction, and thus extends for ten miles, to a point on the south shore called *Moota Point*, and a creek, *Jukarda*, on the north. The depths of this reach, in mid-channel, are $5\frac{1}{2}$, $4\frac{1}{2}$, $4\frac{1}{4}$, to 5, 6, and 7, fathoms. Pursuing, thence, an easterly course, its depths alternately shoalen and increase to a great distance.

From *Boonyadoo Creek*, or the Fourth River, which faces the mouth of the Gambia, to *Jukarda Creek*, above-mentioned, is a line of coast, one mile (*nautic*) in breadth, and 42 miles in length, the sovereignty of which was ceded to his Britannic Majesty, by treaty with the king and chiefs of Barra, signed at *Jillifree*, 15th of June, 1826. A small spot (400 yards by 300) occupied by the French, at *Albreda*, excepted.

CAPE ST. MARY TO CAPE ROXO.—From *Cape St. Mary* (the true Cape) the coast stretches 11 miles W.S.W. to the *Bald Cape*, where *St. Anne's Bank*, with the *Tongui Rocks*, extend about a league into the sea, and include three sandy islets, called the *Byjols*.

Upon the coast of Cape St. Mary, the ground varies all along, but it becomes whiter to the southward: when past the cape, you find a reddish sand, which, at two or three leagues more to the South, changes into a gray, then into a whitish, sandy bottom; and, about Cape Roxo, it becomes such fine sand as that which is put in the time-glasses. These varieties of ground extend from 25 fathoms in the offing, to 5 fathoms off the shore.

The coast between the *Bald Cape* and *Cape Roxo*, in a distance of 20 leagues, is very low, with a sandy beach, and covered with trees. The middle part is one low and continued forest, with clusters of large high trees, at a distance resembling islands.

In sailing between the two capes, by keeping in 5 or 6 fathoms along shore, you will find that depth down to the entrance of the *River Casamanza*, 4 leagues to the northward of Cape Roxo; there you have only 4 fathoms, and the ground mostly red sand. About two leagues southward from that entrance, and abreast of a clifly point, near which you may anchor, the ground is so clammy, about a musket-shot from the shore, in two fathoms of water, that the lead is brought up with difficulty.

The ENTRANCE of the RIVER CASAMANZA is situate about 16 leagues to the southward of *Bald Cape*. If a bar did not obstruct this entrance, the river might be navigated by frigates; but it can be gained only by a very narrow channel, having a depth of 2 fathoms.

The Portuguese, established on the healthy and fertile banks of this river, have ascended to the distance of many leagues from its mouth; they have several establishments on it, the principal

principal of which are called *Zinghikor* and *Makia Kaconda*. They have carried on an advantageous trade, especially in ivory, rough hides, aromatic seeds, and woods for dyeing, with the Feloop and other negroes, who inhabit the banks of the river.

There is now a small French establishment at the mouth of the Casamanza, on the northern point. Toward this there are two passages, divided by the Bar, which extends outward, to the west, nearly four miles. The deepest channel is on the south side of this bank, and has $3\frac{1}{2}$, 6, 4, increasing to 8, fathoms off the point. The river upward, which has a serpentine form, has been surveyed by Captain Boteler; and from his survey it appears that there is another French settlement, the Factory of *Berrin*, at ten leagues up the river on the south side, and three leagues below *Zinghikor*, which is on the same side. The soundings in mid-channel, from the entrance to the latter place, vary from 8 to 4, 6, $3\frac{1}{2}$, 5, 6, $3\frac{1}{2}$, 8, and 5, fathoms.

CAPE ROXO (lat. $12^{\circ} 21'$) is improperly called a *Cape*, it being an obtuse point of low land, from which the coast takes an E.S.E. direction to the *River Cacheo*, or *Rio San Domingo*, the navigation to which is impeded by extensive shoals called the *Cacheo Banks* and *Falulo Breakers*. The point or cape, when bearing E.S.E. or East, presents a down of white sand, of moderate height, covered with brambles. On one of the points formed by the coast to the northward, are a number of tufts, of a remarkably red colour, and it is supposed that, from these tufts, the name of *Roxo* (Red) has been imparted to the headland, although they are distant from it about $2\frac{1}{2}$ miles.

M. Roussin says that, On all the approaches to Cape Roxo the soundings are regular, but the depth inconsiderable. From the River Casamanza, to the distance of two or three miles from shore, there is a depth of only 6 to 4 fathoms. At 10 miles to seaward are 8 and 7 fathoms; and at a short distance to the S.S.W. the first bank of the Bissagos is met with.

CACHEO, on the south bank of the river of that name, has been the chief Portuguese establishment between Cape St. Mary and Cape Verga, and was, formerly, very considerable. They carry on the same kind of trade here as at Casamanza. The country is singularly fertile and well peopled.

The mouth of *Cacheo River* is about $6\frac{1}{2}$ leagues to the south-eastward of Cape Roxo, and the entrance is between two reefs. In proceeding for it, give Cape Roxo a berth of about five miles. Steer S.S.E. on soundings of from 4 to 5 and 6 fathoms, on a sandy bottom. Go close to the eastward of *Cacheo Bank*, which has $2\frac{1}{2}$ fathoms of water on it. Continue S.S.E. until you see breakers ahead, and run straight for them, until you are in five fathoms of water. You will see a single tree bearing East, then steer E. by S. leaving a reef, which extends out about four miles from that tree, on your larboard hand: this reef, although it is said to have two fathoms on it at low water, breaks at half tide. Close in to the beach, at the tree, there is a passage of $2\frac{1}{2}$ fathoms, which is fit for small craft only. Continue your course E. by S., when you will be apparently four miles from the land on your larboard hand, and will come to a shoal called the *Mud Bar*, on which there is a depth of only 18 feet at ordinary high water, but is only soft mud, and about two cables' lengths in breadth. You may then see a clump of Palm-trees (10 or 12 in number) bearing E.N.E.; and when these Palm-trees bear N.E. by E., you will be over the Bar, and will have from 5 to 6, 7, 8, and 9, fathoms up to *Cacheo Fort*, by keeping in the middle of the river; and, when abreast of the Fort, which belongs to the Portuguese, anchor in the middle of the river in 9 fathoms.

BISSAGOS and BIJOOGA ISLANDS.—We have now arrived at the archipelago of Bissagos and the Bijooqa Islands.

This archipelago is an extensive assemblage of islands and shoals between the parallels of $10^{\circ} 42'$ and $11^{\circ} 40'$ N. and between the meridians of $15^{\circ} 30'$ and 17° W. Of the interior navigation among the isles little is yet known, and the hostile disposition of the inhabitants, as recently manifested, renders it probable that no complete survey of it, at least in the present age, can be made.

The principal isles that constitute the archipelago are said to be sixteen in number, besides many islets, all surrounded by shoals, as shown on the chart.*

The Archipelago is bounded on the north by the **JEBA CHANNEL**, or **GREAT CHANNEL**.

* For the positions, see the Table, page 29.

of BISSAO; and on the east by the CHANNEL of RIO GRANDE. These channels were partially surveyed by the officers under Captain Roussin, in 1818, and Captain W. F. Owen, in 1826; and to their surveys we owe our knowledge of the navigation presently to be explained. The southern breaker, called that of the *Bayadere*, was discovered in 1818, and is represented by M. Roussin in latitude $10^{\circ} 42' 56''$, longitude $16^{\circ} 17'$, and the mouth of the Eastern or Rio Grande Channel is seven leagues more to the eastward.

JEBA CHANNEL or CHANNEL of BISSAO.—The main land, forming the north side of this channel, is intersected by several rivers, which divide it into islands. The first of these is *Cacheo*, then follow *Jatt*, *Bassi*, and *Bissao*, of all which the land is low. But there is, near the S.W. end of Jatt, at 13 leagues S.S.E. [$S.E. \frac{1}{2} S.$] from Cape Roxo (lat. $11^{\circ} 50'$) a small, but conspicuous isle, named *Cayo*, which is bold-to, and very useful as a sailing mark. This isle, when on an easterly bearing, appears like three isles, but, on nearing, will be found to be connected with a flat, which is common to all, though intersected, at high water, by shallow lakes. Its soil is sandy, and mixed with flinty rock. The beautiful trees, with which it is covered, may be seen, in clear weather, at 4 or 5 leagues off. At 6 leagues more to the eastward [$E.S.E.$] off the S.E. end of Jatt, are several islets, called the *Ancoras*, which distinguish the western side of a river, bearing the same name.

The islands, generally, which border the Jeba Channel are not high. The beach is generally of white sand, interspersed with black and red rocks, which, being covered with lava, are, doubtless, with the whole Archipelago, of a volcanic origin. They are all well wooded to the sea-side; and the height of the trees, with their vigorous appearance, indicate that the soil must be fertile. The island Bissao, on which the Portuguese are established, is not so thickly wooded as the others; but this is owing to the clearance they were obliged to make for their safety, as the isle is equally fertile as the rest. The large isles of the Archipelago are inhabited by a race of negroes, known in the country by the name of *Papels*.

On the Rio Grande, the Portuguese have several establishments. The settlements of Portugal, on the coast, do not extend beyond Cape Verga. The objects of trade consist chiefly in elephants' teeth, wax, hard soap, rough hides of every kind, dyeing and building wood, indigo, cotton, drugs, resin, and resinous gums, gold in small quantities, orchilla, &c.

The extremity or N.W. part of the Bissagos Shoals is composed of hard sand. From this extremity the bank and isles extend to the southward and south-eastward, 23 leagues, toward the Eastern Channel of the Rio Grande; and the flat, which is from twelve to six leagues in breadth, is interspersed with banks above and under water, and islands either dry, or drowned and marshy, the detail of which is little better than unknown.

On the 25th of December, 1789, the sloop *Endeavour*, of Liverpool, struck on the N.W. end of the shoal, to the westward of the island named *Carasche*, in latitude $11^{\circ} 38'$. Captain S. Gamble, who was a passenger in the sloop, says, in his journal, that she got over the reef, but, not being able to find a passage through the shoals and islands, was, after twenty days' search, obliged to return the same way she went in, and carried three fathoms of water over the bank. All the islands they saw were inhabited, but the natives did not appear to have any canoes, and the few which they persuaded to come on board, in hopes of finding a pilot among them, became sea-sick. When the vessel struck, *Carasche* bore E.S.E. about four leagues; and, when she was near the northernmost point of that island, the isle or kay, called *Isle Cayo*, on the north side of the Frith, bore N.N.E.

The north edge of the shoals of Rio Grande, adds Captain Gamble, is in latitude $11^{\circ} 40'$, and we led round them in $11^{\circ} 43'$, carrying from 11 to 15 fathoms. The tide of ebb runs very strongly over the flats to the S.W.; and, within the heavy breakers, the ebb runs W. by S., and the flood E. by N. The tide, at full and change, rises 12 feet.

The PASSAGES to and from BISSAO.—Cape Roxo has already been described. Should you fall in with this point in the evening, come to an anchor, bringing it to bear North, as then you will be well laid, in order to proceed farther.

The outer part of the Breakers of *Falulo* bears S. by E. [$S.S.E. \frac{1}{2} E.$] $17\frac{1}{2}$ miles from Cape Roxo, and lies to the south-westward of the River Cacheo. The breakers are divided into two groupes, and extend in a true E.S.E. and W.N.W. direction three miles. They are very steep-to, and close to them are from 6 to 3 fathoms. A merchant vessel may advance within sight of them, and thence proceed toward the isle Cayo: but the best way of proceeding to the Jeba or Bissao Channel is as follows:—

From

From a point at two leagues to the westward of Cape Roxo proceed S.W. by W. $\frac{1}{2}$ W. [S.W.] 12 miles; then haul up on the larboard tack, as at this distance the depth increases. The next course will be S. $\frac{1}{2}$ W. [S. by E.] for 25 miles, which will bring you to the parallel of $11^{\circ} 47'$, where a depth of nearly 50 feet, with a muddy bottom, will be found.*

You now enter the Channel of the Jeba, and will find that a run of twelve leagues, E.S.E. $\frac{1}{2}$ E. [East] will lead to the south point of the islet *Cayo*, the trees of which, as we have shown, may be seen at a considerable distance. All the space to the northward of this track is replete with banks which extend to the main shore; but those of *Falulo* are the only ones that break incessantly.

Proceeding thus, the depths will be found always regular, from 7 to 9 fathoms, and the bottom constantly of mud. It must be observed that, when entering the Great Channel, the northern banks should be approached in preference to the southern. As the former descend by a gentle declivity, they always warn a vessel when she is out of the channel, by each cast of the lead giving a gradual decrease of depth. The southern banks, on the contrary, are extremely steep; close to a depth of forty feet there will be found one of twenty-five, on a bottom very unfit for anchoring.

In order to be assured that you are keeping the channel, keep constantly sounding, and observe that, in all the channels which separate the banks to the N.W. of the *Bijogas*, the bottom is almost exclusively soft mud without any mixture. At each cast, therefore, when the lead sinks into the ground, you may be certain that you are following the proper channel, and the middle of it may be found by the lead sinking deeper and being less easily extricated. If the bottom becomes hard, it is a certain proof that you are near some bank, and if the vessel has much way on her, she must alter course directly for that side on which the bottom is softer.

A vessel seeking or running for the anchorage off the islet *Cayo*, need not mind passing close to it. This part is perfectly safe to the beach, at half a mile from which there is a depth of eight fathoms, on a soft muddy bottom.

The Great Channel, on the meridian of the islet *Cayo*, is about four leagues in breadth; but this space is divided into three channels by means of two banks, on which there is very little water. Of these banks the northernmost is the *Bank of Cayo*, having a depth of only ten feet on it, and lying four miles to the southward of the islet of that name. It is rather narrow from north to south, but its length from east to west is about five miles. The best of the three channels is to the northward of this bank, in which there are from seven to nine fathoms.

At the distance of two miles southward from the *Cayo Bank*, is the *Bank of Carasche*, which breaks continually, and a part of which is dry at low water. Like the first, it extends true East and West, and its length is also about five miles. The least depth between the two is nine fathoms. At four miles to the southward of the *Bank of Carasche* is the north point of the island of the same name, which forms part of the south Bank of the Great Channel. There is a channel between the bank and the island, but the depth is irregular, and the bottom is bad.

On advancing for the Portuguese Establishment at *Bissao*, and having arrived to the eastward of the two banks above mentioned, you may safely proceed five leagues S.E. $\frac{1}{4}$ S. [S. 60° E.], and will thus coast the island of *Jatt* to its S.E. point, which, from the trees upon it, appears to be the highest part of the whole coast on the northern side of the channel. The course thence is E.S.E. [E. 5° S.] six leagues, in which extent the *Ancoras*, situated to the S.E. end of the island of *Jatt*, the channel between that island and *Isle Bassi*, and the southern part of the last island, will be passed successively to the northward: on the south you will cross a large bay formed by the islands *Carasche* and *Corbelle*, will pass the *Parroquet Islands* [*Papakawa*], lying to the eastward of the latter, and finally arrive on the meridian of the western point of the Island of *Bissao*, at about three miles from it. From the *Parroquet Isles* the southern side of this channel is formed by a bank, several parts of which are dry at low water.

* Vessels coming from the northward, after making Cape Roxo, may steer S.W. from that cape, in 8 fathoms, all along, until they catch from 10 to 12 fathoms, green oaze; then steer S.E. by E., taking care not to get into less than 6 fathoms on the larboard hand on *Cacheco Bank*, &c.—*Mr. Swann, a pilot.*

To the southward of the town of *Bissao* is an islet, called *Bonn*; and at two miles above this is another, called *King's Isle*. On the south side of the river is another called *Arcas*, which is 7 miles from Bonn, and nearly on the same meridian. The latter lies on the eastern side of the channel to Rio Grande, and is the distinguishing mark for that channel. From the S.W. end of the isle Bissao the course to Bonn is E. $\frac{1}{4}$ N. [*E. 20° N.*] This course runs parallel to, and within two miles of, the Island of Bissao, and passes over several patches, on which there are only 26 feet at low water. These patches are to the northward of the eastern channel, the mouth of which is near the Island of Arcas, which is seen at the same time. They may be avoided by altering the course occasionally; but as the depth on them is not less than 26 feet, and does not experience any considerable rise, as they are of no great extent, a vessel may pass over them without any fear, and may shape a direct course.

At three miles and a half W. $\frac{1}{2}$ S. [*W.S.W.*] of Bonn, is the *Point and Grove of St. Martin* of Bissao, where the coast forms a slight elbow. This point is not to be approached with safety, nearer than a mile and a half by a large vessel. At three miles S.S.W. [*S. 5° W.*] of this point, and in a continuation of the line from Bonn to the highest point of King's Island, lies one of the knolls above spoken of. It is the easternmost to be met with on the course above stated. To the eastward of the meridian of Point of St. Martin, the depth increases toward Isle Bonn. This knoll, with 26 feet of water on it, is a small bank of not more than a hundred fathoms extent in every direction, having deep water to the northward and southward of it.

When a vessel is within three miles S.S.W. $\frac{1}{2}$ W. [*S. by W.*] from Bonn, she should steer direct for it, so as to pass within 200 fathoms to the eastward of the island. This part is extremely steep, having, at the above distance from it, a depth of eight fathoms. From hence she should run between King's Island and the Fort, and anchor in 6 to 8 fathoms, on a soft muddy bottom. Having doubled the Isle Bonn, the coast of Bissao should be approached nearer than King's Island, as the depth is greater, and varies from 6 to 7 fathoms. It would be superfluous to mention the necessity of sounding constantly in this internal navigation.

BISSAO.—The Road of Bissao lies in the principal stream of the River Jeba, between the eastern side of the Island of Bissao and the small island opposite, called King's Island. This roadstead is perfectly safe in all weathers. It is so completely sheltered, that the sea is always smooth; and the bottom is of such a nature that with good ground-tackle a vessel may ride there in any season. It is advisable to moor N.E. and S.W., as the tides set in this direction: and in the rainy season, as the squalls come from the S.E., the anchors, being thus placed, will bear an equal strain.

The Portuguese Fort stands at a hundred fathoms from the beach, and is a square redoubt flanked at the four angles by a bastion. The wall of the ditch, which on each face is about a hundred paces in length, may be about 30 feet in height. The magnetic variation observed in April, 1818, at the anchorage, was $17^{\circ} 30' W.$

The *Watering-place at Bissao* is on the beach, at about 300 paces to the southward of the fort. It consists of several pits, dug about four feet deep in the sand, and may afford sufficient water to fill thirty casks in twenty-four hours. This water before being filtered, coming from sand and rock, is not agreeable to the taste, although it has the reputation of being wholesome, and of keeping well; nevertheless it should not be drunk without being previously acidulated, or purified by red-hot shot. It may be either brought on board in boats, or rafted off at high water.

Independent of wood and water, excellent bullocks, of about one hundred weight, at the rate of from twenty to twenty-five dollars each, have been had at Bissao; also goats, pigs, and poultry. There is also rice, maize, and yams, and some fruit, such as bananas, lemons, and oranges. These articles are exchanged for gunpowder, brandy, iron, clothing, and dollars, by applying to the governor.*

The waters which surround the Bissagos are far from being well supplied with fish, and it is erroneously affirmed, in some works on Africa, that amongst these islands cargoes of salt fish may be procured. Mud prevails too much in the bottom; and the few fish which

* Bissao now appears to have declined very much. Captain Owen says that it is an excellent and spacious port, and "some bullocks, with difficulty, were obtained here."

are found are not even considered as wholesome. No dependance can be placed on this resource, between the Gambia and the Isles de Los.

Winds in the Great Channel of the Bissagos.—The winds here follow nearly the direction of the land, and vary their course according to that of the channel. In the Great Channel they vary from West to North; at the anchorage of Bissao they are generally from S.W. except in the morning, when they are from the northward. In the rainy season, which commences here in the beginning of June, and continues about five months, they blow from the S.E. with the tornadoes, as on the whole coast, and then, passing round by South, return to the northward. Whatever may be the direction of the wind, a vessel, with the assistance of the tides, may always find her way into or out of the Great Channel, and the working is extremely easy with the assistance of the new Chart, which should accompany these directions. The remark, respecting the northern bank being approached in preference to the southern, should be attended to here; the islands to the northward being perfectly safe, whilst those to the southward are surrounded by very steep and hard banks. Large vessels should not approach nearer to the Isle Corbelle than three miles, nor to the line which connects it with Isle Carasche. All the space which lies between the islands, to the southward of this line, is filled with banks, having little water on them, and the greater part of which lie in the channel. If it should fall calm, and it be wished to let a vessel drift with the tide, she must not be abandoned to it until she has opened the channel she intends entering.

Anchorage in the Jeba or Great Channel.—A vessel may anchor any where in the Great Channel, the bottom being of soft mud and excellent holding-ground, with the exception of one place at two miles and a half to the southward of the Isle Jatt. Here the depth is from 20 to 22 fathoms, and the bottom of coarse gravel. In all other parts of the channel, the depth varies from 13 to 6 fathoms, without any sudden alteration.

TIDES.—The usual prevailing currents on the coast to the northward of Cape Roxo, are found to be completely changed on passing this cape. They have here no longer one only direction; and, in all the channels of the Bissagos, are superseded by tides, which are more or less regular. Those in the Jeba or Great Channel are perfectly so. Westward of the Isle Cayo, the flood sets S.E. and the ebb N.W., each six hours, or nearly so, with the exception that the current gradually assumes these directions, requiring nearly an hour, from the change, before it is completely settled in its course. The flood generally sets to the northward, and the ebb to the southward. The greatest difference which has been observed between the high and low water marks, is eight feet; and at the equinoctial full moon the rate of the flood and ebb is about one mile and two-fifths an hour; at other times it never exceeds one mile. At the entrance of the Great Channel, which is six leagues to the westward, and on the parallel of the Island of Cayo, it is high water at full and change, at 9 h. 15 m.

From the meridian of Cayo, and as far as that of the Isle Bonn, the stream follows the direction of the channel; and here the tides are regular. It is not known that the length of the ebb exceeds that of the flood. The greatest rate of either never exceeds two miles and a half per hour, in spring-tides, and the rise is found to be eight feet, as outside the channel.

On the meridian of Cayo, it is high water, at full and change, at 11 h. Before Bissao the rate of the highest tides never exceeds 2.6 miles per hour, and the rise is never more than 14 feet. In common tides, the rate is never more than two miles per hour, and the mean rise is seven feet and a half. It is high water, at full and change, at the anchorage off Bissao, at 12 h. 30 m.

CHANNEL of the BOLOLA or RIO GRANDE.—The Eastern channel, or Channel of the Rio Grande, branches into the Jeba Channel to the westward of the Island Arcas. The western bank is formed by a flat, which extends to the eastward of the Parroquet Islands and *Isle Galinha*, the banks which connect these with the *Hog Islands*, and by *Kanyabac Island*. The eastern bank comprises the *Isle Arcas*, *Bulama*, or *Boolam Island*, and the banks which connect these two islands. It is then intersected by the mouth of the *Bolola* or *Rio Grande*, after which it again commences at Bossessamé, and forms a chain of reefs as far as the Island Yomber, in 11° 3' N. and 15° 40' W.

The channel is then divided into two branches by a bank, which is about four leagues in extent from North to South, and on which, amongst several islets and breakers, are situated *Isle Cavalho* and *Honey Island*. Seven miles to the southward of the latter, lies *Pullam Island*.

Island. The western or main branch has, on its western side, the *Island of Orango*, and a long chain of reefs, which extend S.S.W. from that island.

To Enter from the northward.—The first difficulty which presents itself, on entering this channel from the *northward*, is when passing the *Isle Arcas*. From the S.W. part of this island a bar stretches out, on which there is a depth of only 19 feet at low water. It is terminated, at the distance of four miles, by a rocky bank, which also forms a part of the bar. Although the depth may be a little more at the distance of a mile from this bank, a large vessel should not venture near it without previously considering well the time of tide. If she be obliged to anchor, the best ground will be found near the meridian of Arcas, on the north.

The mark for running through this channel, from a position bearing W. $\frac{1}{2}$ S. [W.S.W.] from the *Isle of Arcas*, is to steer so as to keep the western point of the *Island Bulama*, constantly bearing South [S. 17° E.], until within two miles of the shore of this island. From hence, if it be intended to go to the southward, a vessel should steer for the middle of the strait formed by this island and *Galinha*; but should a vessel be bound to the northward, she should steer N. by E. $\frac{1}{2}$ E. [North] from the above bearing of Arcas, until she has passed the parallel in which it lies.

BULAMA or BOOLAM.—The western end of this isle may be approached within a mile. This island, which is well wooded and of moderate height, has several well-sheltered roadsteads, which afford safe anchorage. One of these, on the S.W. side of the island, has a depth in it of from 22 to 24 fathoms, with a bottom of soft mud. The configuration of the land is such, that the strength of the current, being carried more to the southward, is almost imperceptible at this anchorage; and although the tide rises from 12 to 15 feet, the sea is generally smooth and the landing easy. At this roadstead, fresh water may be procured from two places.

Bulama is generally considered as very fertile. Its situation at the entrance of the *Rio Grande*, which may be navigated to a considerable distance, the facility of its approaches from the westward and southward, and the safety of its anchorages, render it one of the most important islands hereabout.

From the western point of Bulama, the course is S. by E. $\frac{3}{4}$ E. [S. 36° E.], the distance three leagues and a half. This course crosses the mouth of the *Rio Grande*, which separates Bulama from *Bossessamé*; continues along the banks to the S.E. of *Galinha*, at the distance of a mile, the greater part of which are dry at half-tide, and extends to about a mile and a half from the banks on the western part of *Bossessamé*. The soundings on this track are very irregular, and vary from 35 to 8 fathoms, with a bottom, generally, of sand and gravel.

When at two miles to the westward of Bossessamé, a vessel may run for *Kanyabac Island*, steering South three leagues. The depth in this course varies from 7 to 20 fathoms, red sand and shells. To the westward of this track are the four little islands, called the *Hog Isles*, and in the country *Rouban*, *Banak*, *Chiveya*, and *Corett*. The latter, which is the northernmost, is the most remarkable, being covered with large trees.

KANYABAC.—All the eastern side of *Kanyabac* is perfectly safe, and may be approached to within a mile in from 6 to 10 fathoms. The S.E. point, which the inhabitants call *Barel*, is about 60 feet high, very bold, and formed in peaks. On rounding this point to the westward, there is a small cove, called by the inhabitants *Port Manel*. It has a very good bottom for anchoring, but at low water a very small depth. This part of the *Eastern Channel* is formed by the S.E. coast of *Kanyabac Island* on one side, and a continued chain of banks, on which the sea breaks, on the other. The latter connect *Bossessamé* and *Yomber Islands*, and have on them an islet of white sand.

Kanyabac Island, one of the most considerable of those which form this channel, is of a moderate elevation, and rather higher on the southern than northern end. It presents alternately a sandy, volcanic, and ferruginous, soil. If we may judge from the numerous population, and the quantity of cattle on it, this island must be very fertile.

The large trees, called in the country *Pullam Trees*, with palm-trees, and vegetables of all kinds, are very plentiful on it.* The Port of Manel, lying between Point Barel and an islet

* Captain Belcher has noticed that the *Pullam tree* is the *Bombax* or *Silk cotton tree*, and has no reference

islet called *Pomp*, seems to be the chief resort of all the canoes belonging to the inhabitants of the southern part of the island.

From *Point Barel*, near the middle of Kanyabac, the course is S.W. $\frac{3}{4}$ S. [S. 30° W.] 13 miles. This will take a vessel within two miles of the western side of a very extensive bank which lies to the northward of the Isle Cavalho. The depth on this course is from 10 to 21 fathoms, the bottom of sand and shells.

From two miles west of the banks to the northward of Isle Cavalho, the direction of the southern part of the Channel is S.W. $\frac{3}{4}$ S. [S. 30° W.] This bearing, extended to a distance of 13 miles, will pass the eastern shore of Orango Island at a proper distance, and also breakers which stretch more than two leagues off to the S.W. of this island, and to the parallel of Pullam Island, at three leagues from it. Orango Island is the most considerable of the Bissagos. From hence any course between S.S.E. and S.W. by W. [S.E. $\frac{1}{2}$ S. and S.W. $\frac{1}{2}$ S.] will lead a vessel perfectly clear of all danger, and out to sea.

The eastern part of Orango is not very high, and is of the same nature as the adjoining islands. The most conspicuous point, when bearing N.W. by W. $\frac{1}{2}$ W. [W. by N.] is a well-defined cape, much higher than the adjacent land, and remarkable from several spots of yellow sand, which form a striking contrast to the brown appearance of the coast. This cape, forming the S.E. point of the island, is called *Cape Cameleon*, or *Yellow Cape*. At $4\frac{1}{2}$ miles to the East of it is a spot nearly dry at low water; but the depths between are from 5 to 11 fathoms.

Pullam Island, which derives its name from that given by the natives to the large trees [Bombax] with which it is covered, has not above a mile of extent in any one direction, and is very little above the level of the sea. Its shores are rocky, and rendered very difficult for landing by the constant surf which breaks on them. It is impossible for large vessels to approach this island: from S.W. to E.S.E. it is bounded by flats, which extend to a distance of four miles from it, several parts of which are dry, or breaking.

On the 21st of April, 1821, H.M. ship *Leven* arrived off the Bijooga Islands, and anchored between Yomber and Orango. Upon the latter many natives and herds of cattle were seen. On the following day the *Leven* grounded upon the shoal at half a mile from the East shore of the Isle *Bawack*, between Kanyabac and Orango, where she lay in a perilous situation until the next tide, when she happily got off. On anchoring, many canoes came off, with natives bringing various articles to exchange for tobacco: but they had been reported as ferocious, dishonest, and treacherous; and they were found to be so.

The natives are savage, both in appearance and disposition. Their dress is composed of a single goat-skin, fastened tight round the loins. They are ornamented with cowrie-shells, and wear numerous *gregories*, or charms, suspended round their necks, consisting of boars' tusks, antelopes' horns, bullocks' teeth, cone shells, and beads. Tobacco, knives, and razors, were the only articles they would receive in barter; and one striking and novel trait in their character is, a great antipathy to rum. For a large fowl they demanded a handful of tobacco, and for a bullock not less than a musket. Their canoes vary from 20 to 40 feet in length, 3 to 5 broad, and about 3 deep, with projecting head and stern; the bottoms, being composed of one piece of wood, are consequently much mis-shapen by the irregular growth of the tree. Their paddles are six feet long, broad and clumsy; a term which is equally applicable to their use of them, as they make but little progress through the water.

Information was gained that on *Kanyabac* there are many villages, each subject to its own king or chief; and that the elephants, which are very numerous, in their efforts to procure water, dig neat wells with their feet, which, as there are no streams, the people preserve. The country on the right bank of the Rio Grande [Bolola] is called by the natives *Gwinara*, and not *Ghinala*, as usually written. Its chief productions are ivory, gold, wax, hides, and horses, which they readily exchange for iron-bars, cutlasses, fire arms, and ammunition. It is populous in the interior, and has a mercantile establishment, that of a Mr. Laurence.*

The banks of the river have the appearance of being thickly inhabited, but the huts with

reference to the Palm. *Pullam Island*, which will be presently described, as deriving its name from the "large trees with which it is covered," can hardly boast half a dozen palms, which hide their diminished heads beside the more majestic *Pullam trees*.

* For some account of this person, see Capt. Owen's Narrative, Vol. I. p. 257.

which they are apparently studded, are, upon a nearer inspection, discovered to be ant-hills, which are built in exactly the same form, and of the same height.

On the Island *Galinhas* (*Hen's Isle*) the tracks of elephants and hippopotami were seen; and the largest sized boa-constrictor is also frequently seen in this island. The natives have great respect for these reptiles, and imagine that whoever destroys them will die himself. This island resembles Bulama in every respect, having fine savannahs and abundance of water; both are surrounded by an extensive flat, which renders landing exceedingly difficult at any other period than high tide.

The idea we had been led to form of these islands was extremely erroneous; as, instead of being "low and marshy, with scarcely a channel for boats between their muddy shores," we found them a cluster of the most beautiful, fertile, and inviting, islands, with moderately high and bold shores, separated by deep water, and containing many fine harbours; most of them being inhabited, and each village having its independent ruler. According to the customs of these people, every vessel stranded upon their shores is forfeited to the chiefs or people, in consequence of which they considered that they had a just claim to the *Leven*, when she lay grounded near Bawack.

It is a practice of these islanders to rear their poultry and stock on the small islets, some abounding only in fowls. The natives of Kanyabac breed cattle on Yomber, and horses on Honey Island, which the people of Bissao called *Yulka-vulyo*, being a corruption from the Portuguese *Ilha-Cavalho*. *Galinhas* appears also, by its name, to have been used for raising poultry, and many of the islets do not contain twenty acres of ground, yet are well wooded and fertile, with some stock on most of them.

In 1832 these islands were visited by Captain Belcher, in H.M.S. *Ætna*, who has also described the repulsive habits of the people. No bullocks, though numerous, could be obtained otherwise than for arms and powder. The whole of the islands, he observes, are of volcanic origin. Yomber, Honey, and Cavalho, are at times inhabited, but Pullam is not. On all, except Orango, vegetation appears to be luxuriant, but the very sandy nature of Orango renders this impossible. Fish are abundant throughout, but rocks quite as much so. On Pullam are some poisonous roots, which should be touched with caution. The plant has a lily stem and flower, and is shaped something like a turnip: another has the bulbous root of the lily.

A more circumstantial description of the islands and inhabitants, by an officer of the *Ætna*, is given in the *Nautical Magazine*, No. 12, page 82, and No. 14, page 206; which, in conclusion, remarks that the principal feature in the character of the people is avarice, which can be gratified only by the possession of whatever they see. During the last forty years they do not appear to have advanced one step in civilization, and their treatment of strangers, with the difficulty of access to their islands, will long perpetuate their barbarous condition.

"In justice to them, however, it must be observed, that there is too much reason to believe that they have not always been treated fairly by the few white people with whom they have had intercourse: and there is little doubt that their history would discover much that might be adduced in extenuation of their singular manners."

WINDS, &c. in the EASTERN CHANNEL.—The winds in the Eastern Channel are generally light during the fine season, particularly in the night or morning. They set in gradually in the afternoon, and blow almost always from S.S.W. round by West to N.N.W., but they remain a very short time at any intermediate point, and soon follow the direction of the land, which, as well as we could determine, trends nearly N. by E. and S. by W. Easterly winds are limited entirely to the rainy season.

The **TIDES** are as regular in the Eastern as in the Jeba or Great Channel. The length of the ebb is equal to that of the flood; the former sets to the northward, the latter to the southward, but the different points of the channel, and the irregularities of the bottom, affect those directions. The mean rise of the tide is from 12 to 15 feet. The strength of the stream varies according to the breadth and depth of the channel, being greater where it is confined than in the wider parts; it is consequently more considerable in the Strait of Bulama, and the Honey Island Channel, than in any other part. Nevertheless, it seldom exceeds two miles and a half per hour, but is frequently as much as two. At two miles to the westward of Pullam Island, it is high water, at full and change, at 10h. 15 m. The magnetic variation, in May, 1818, was found to be 17° 33' W.

RIO NUNEZ.—The RIVER KAKOONDEE or KAKUNDY, commonly called the Rio NUNEZ,

NUNEZ, or River of NUNA TRISTAÓ, is a very considerable river, broad at its entrance, but impeded, by several shoals, among which the least water in the channel is 3 fathoms. It has been celebrated as a place of trade for ivory. The situation of the entrance, as shown in the Table, page 29, is $10^{\circ} 36' N.$ and $14^{\circ} 42' W.$ It was formerly laid down much farther to the south and east.

Between the mouths of the Rio Grande and the Rio Nunez, the coast is very imperfectly known, but it appears to be, in general, shoal and dangerous to a great distance from shore. On the edge of the bank, in latitude $10^{\circ} 37'$, and at 25 miles S.E. $\frac{3}{4}$ S. [S.E. $\frac{3}{4}$ E.] from Pullam Island, is a rocky bank, called the *Alcatraz*, with a rocky islet in its centre. It is surrounded with breakers, and the reefs extend from it both to the N.W. and S.W. At 6 miles to the westward is a depth of 20 fathoms.

Captain Belcher has described the islet *Alcatraz*, the landing to which was not at all difficult, but the whole summit of the rock was covered with boobies (*pelicanus sula*). A boat's crew were employed to collect the eggs, who obtained more than 600, which proved a grateful treat, being large, and not much inferior in quality to those of the plover: but the pestiferous odour of the soil was so disgusting, and an insect which breeds on the bodies of the birds so annoying, that we cannot advise any one to land again for the same purpose.

Alcatraz is decidedly a volcanic production. Its summit is 40 feet above the sea; level, but traversed almost down to the water-line by fissures which gape from one to five feet. Quite destitute of vegetation, and from 60 to 100 yards in length. Sharks and turtle are always near it; but the latter are not easily taken.

Alcatraz may be approached on the S.E. side; but the reefs stretch from it 5 miles S.W. true, and about three miles in width, at right angles to this bearing. Lat. $10^{\circ} 38'$, long. $15^{\circ} 20\frac{1}{2}'$.

Nearly in the route between the *Alcatraz* and the *Rio Nunez*, in lat. $10^{\circ} 30'$ and long. $15^{\circ} 11'$, is a much more dangerous reef, surveyed, in 1826, by Captain Owen, and by him named the *Conflict Reef*. Its western edge is 14 miles to the S.E. from the *Alcatraz*, and its breadth each way is from 3 to 4 miles. Two other rocky banks, to the southward of it, are comprehended within a distance of 8 miles; the south point of the latter is in $10^{\circ} 20'$, and has near it a depth of 11 to 16 fathoms. From this spot the mouth of the *Rio Nunez* bears about E.N.E. $\frac{1}{2}$ E. [N.E. by E.] 10 leagues.

The descendants of the Portuguese, who still exist on the banks of the *Rio Nunez*, are so mixed with the negroes, that they have been described as negroes themselves. The *Nalooos*, in the country to the East, a very intelligent and gentle people, are farmers and graziers; they grow a quantity of rice, and their lands are fertile and populous. They are said to have made some progress in agriculture; the indigo and cotton which they raise, are the finest in all this part of Africa; and they manufacture pieces of cotton cloth, which, from their texture and fine colours, are much sought after by the Foulahs of Teemboo, in the country to the eastward, who purchase them at a high price.

In the old charts of this coast no island is laid down at the mouth of the River Nunez, and we first learned, from the information of Captain Livingston, that a considerable island, where Woodville formerly gave a shoal, had arisen within the last 30 or 40 years. It is called *Sandy Island*, is now covered with trees, and has many tall palms upon it.

Sandy Island, according to Captain Belcher, is in latitude $10^{\circ} 36' 37'' N.$, longitude $14^{\circ} 42' 19'' W.$ Forty years ago it was a mere sand-bank, even at low water; subsequent deposition, however, has not only formed it into an island, at least six feet above high water, and bearing large trees, with a fair surface soil, but has also added a very extensive range of shoal on its northern, western, and south-western, sides. It is said that a passage into the river once existed on its northern side, as well as on its southern, but this seems improbable, as the bottom there is rocky as well as sandy. It is remarkable generally on this coast, that, wherever rocks are thus found, sand-flats also exist, although surrounded by mud, and without any apparent source for the supply of sand. This is not strictly the case at the Nunez, there being a red sandy cliff, in course of disintegration or decay on its S.E. side; but the identity is even here not certain, both the colour and size of the grain being very different. Farther north than *Sandy Island* there is still a passage into the river for vessels drawing less than 12 feet; but it is narrow, tortuous, and appears to be rapidly filling up.

Captain Belcher visited the River in April, 1831, and the following passages are given from his observations.

Vessels bound to the Nunez should make the land in $10^{\circ} 31' N.$; or, if coming from the southward, should, at least, not advance into less than seven fathoms till in that latitude. They will then approach the river, steering $E. \frac{1}{4} S.$ [$N. 75^{\circ} E.$] through regular soundings; and it is necessary to remember, chiefly, that, with a flood-tide, there is a dangerous rocky flat on the starboard beam going in, while, on the other hand, a vessel may play with the edge of the breakers on the point of Sandy Island on the larboard side. The constant warning, also, "Keep in mud," which is familiar in all channels along this coast, should be here especially kept in mind.*

For a vessel to refit, no place can be better adapted than Sandy Island. It is uninhabited, and a vessel may be moored within 150 yards of low water mark, or even less if required, but should be prepared to haul off in case of a tornado. Small vessels may be grounded, or hauled up, for repair or examination; a space sufficient for the encampment of a crew, even of a line of battle ship, is free from trees; and stores may be conveniently landed. Immense quantities of drift wood lie piled on the S.W. side; and plenty of live timber grows on the island, of which the palm yields an excellent cabbage for the use of the sick or convalescent.† Fresh water alone is scarce and ill tasted; and a great annoyance arises from the clouds of fine sand which are incessantly in motion over the island. The temperature, when the *Ætna* was there, did not exceed 105° in the tent; which was, however, oppressive, from the necessity of keeping it pretty well closed, to prevent the sand from imbedding the instruments. A breeze generally prevailed throughout the day, except between nine and noon. The western side is by far the most cool and pleasant, but not so convenient for communicating with the ship.

The river is very serpentine in its form, and the trees on either side impede the wind in its true course. Still, however, a pleasant, and after noon, even a fresh, breeze generally favours vessels bound up, and affords favourable slants in many of the reaches down. The general depth may be stated at $2\frac{1}{2}$ to 3 fathoms at low water, with a rise and fall of about 12 feet; and although the lead generally gives mud, the anchor frequently hooks a rock, and good and long buoy-ropes are especially necessary, which should be got on board the instant the tide slacks, in order to be in readiness to trip the anchor instantly, if found to be foul. The change of the tide is very rapid, and much inconvenience will be felt if completed before breaking ground.

The three principal settlements, *Walkeria*, *Cassasez*, and *Rebucko*, or *Debucko*, are all near each other, and from 70 to 80 miles up. We had formed great expectations of the supplies which could be procured at these settlements, but were much disappointed. Bullocks and sheep could be procured with some difficulty; fowls were very scarce; and vegetables could not be got at all. These native towns are never prepared to meet a sudden increase of demand for food. Of rice alone they seem generally to have a superfluity. Their trade here is the same as that along the adjoining coast, but on a somewhat larger scale; and their dealings in slaves they do not affect to conceal.

Below *Walkeria* not a single habitation was observed on the Nunez, though the cultivation of its banks might be profitably pursued. The want of fresh water prevents the natives settling here; but, from the nature of the soil, and elevation, there can be little doubt that it would be found on digging. The principal internal trade is maintained by the *Foulahs*, who take, in return for their goods, salt, cloth, &c. These travel in parties of 20 to 40, armed with spears, bows, and arrows; the last said to be poisoned. They are a shrewd intelligent people, very active, and are said to possess great bravery and perseverance, and to be inured to hard labour. It is they who bring slaves down to the coast; and it appears scarcely possible for British subjects to traffic with them, without becoming more or less implicated with this trade.

* *Captain Livingston* says, "In making the Nunez, it is advisable to make it from the southward; but beware of the very dangerous *Sankinsal Rocks*, extending 6 or 7 miles to the southward of Bencer or the East Point. The reefs and banks at the entrance of the river are certainly increasing, and generally break, even in moderate weather.

† The old charts represent a river, under the name of *Talagos*, falling into the Nunez from the East, but I have been assured that no such river exists."

† This cabbage makes a delicious pickle, and is considered one of the finest anti-scorbutics in the world, doubly valuable when other vegetables are not to be had.—*E. B.*

The Foulahs travel five days to their country from hence, at the rate of twenty miles a day, and rest two. They generally carry on their heads bales amounting to 60 lb. weight, the heaviest containing salt and beads. Their return is gold, in rings weighing from one to ten ounces each, ivory, slight manufactures of leather, pouches, rice, and fruit. The gold is obtained from alluvial hills; and iron is said also to abound in the neighbouring country; with some hot springs, but none near the settlements.

The aborigines on the Nunez are called *Landamahs*, their language being, however, nearly the same with that of the *Baggas* or *Bagos*; and both call themselves *Saffres*, the name they bore in the time of Queen Elizabeth, when Hawkins first carried away some of them as slaves. One division of them, who occupy the island of *Talahoöncho*, near the mouth of the Nunez, (and of which some remarkable trees are there a principal land-mark,) are complete pirates, treacherous, cruel, and oppressive. They muster strong, with fire-arms, and seldom quit their island. Their town is close by the trees in question, which are seen to the northward of Sandy Island on entering; but they are found on all parts of the same island.

Above Cassasez, which is two miles above Walkeria, the river is much interrupted by rocks of close-grained basalt, several of them presenting a perfect columnar formation. At Rebugco, eight miles above Cassasez, some fragments of close-grained clay slate were also observed to be used for building, and said to be procured in the neighbourhood.

Ten miles above Rebugco the river is fordable, and at 50 miles merely a stream, with repeated falls. At Rebugco the water is fresh at dead low water, and vessels have watered one mile above it. Alligators abound here, and some are of considerable size. It is said that they have never been known to attack any one above Walkeria; but below it the instances are numerous. Off Cassasez they were playing about the boats continually, and one came alongside, and exposing his ugly head, with distended jaws swallowed the paunch of a sheep which had just been slaughtered.

The range of the thermometer, while the *Ætna's* boats were in the river, March and April, was at 6 a.m. from 75° to 84°; at noon from 84° to 94°; and at nine, p.m., from 81° to 83°. The dews were slight; but at other seasons are said to be very heavy, accompanied by a fog, lasting frequently till noon.

THE FOLLOWING OBSERVATIONS on the KAKUNDY or RIO NUNEZ, are from a copious and valuable communication by *Captain Livingston*, who visited the river in the year 1829.

To Enter the Nunez, bring *Sandy Island*, above mentioned, to bear N.E., or perhaps a little (but very little) to the northward of that bearing, and steer in right for the island, which is bold-to on the south side. The shoals generally break, and extend about 5 or 6 miles to the S.W. by W., or thereabout, from *Sandy Island*.

Giving *Sandy Island* a small berth, steer about N.E. for *Big Island*, which, in clear weather, may be seen after passing *Sandy Island*. Keep close to *Big Island*, as a rocky spit extends two-thirds or more over from the *Talabunch* [*Talabooncho*?] or western shore. It is scarcely prudent for a stranger to run much above *Big Island*, but rather to send a boat up the river for a pilot, and one may generally be engaged at *Walkeria*, or a little higher up; or one may sometimes be had from a coasting vessel.

On going up the Nunez in a boat, be cautious not to mistake any of the creeks on the western side for the main river.

In case of necessity, fresh water may always be obtained by digging a few feet deep at the root of any palm-tree.

In going up the river *Captain Livingston* grounded about three-quarters of a mile or a mile to the northward of *Sandy Island*. The vessel lay for two tides on fine sand, without receiving any damage.

When at anchor, on coming down the river, in 7 fathoms, about a quarter of a mile off shore, the centre of *Sandy Island* bore N. by W., and the extremity of the breakers on the long spit of sand which extends five or six miles from the west end of the island, W. by S.

The situation of *Talabunch* [*Talabooncho*?] village may be known by some remarkable large trees which may, in certain situations, be seen from sea, before *Sandy Island* can be descried. I have heard it remarked that, wherever you see a large clump of majestic pullam-trees (the cotton-tree of the West Indies) you are sure to find a negro village; and wherever you

you meet with a palm-tree, you may be sure of finding fresh water, by digging a few feet deep, however arid the soil may appear.

No person ought to land at Talabunch, unless in company with eight or ten others, well armed, and on their guard; but on the opposite or eastern side, *Talabunchana*, the negroes, though of the same tribe, are remarkably civil and honest.

The BARRIER OF THE RIVER, (as it has been translated to me from the Soozee language,) is, I think, about half-way up the river between Big Island and Walkeria. Ridges of rocks, almost like walls, and which appeared to me, when in a boat at low water, like walls of lava, extend about two-thirds across the river from the larboard or western shore; and at about a mile or a mile and a half above that, it is said that rocks, even worse, spit out from the starboard or eastern shore; but these were not seen in passing, when covered with the tide.* There are other dangers in the river, but none of magnitude, until after passing Walkeria and some houses about two miles above it, at Cassashe. These places are both on the eastern or starboard shore. Between them and the village *Rebucko*, is a very dangerous spot: but vessels drawing 10 feet may proceed to the latter near high water.†

Both banks of the Nunez are generally muddy: mangroves grow into the very water, and some of the finest tree or mangrove oysters adhere to their trunks and branches.

In the rainy season, tornadoes are frequent and violent; but, with caution, vessels may have sufficient time to prepare for them. I observed none here to begin with small clouds or a small cloud, but all with heavy thunder clouds.

Vessels going to the Nunez ought to be well supplied with provisions, and not to depend on what may be obtained there, as a great scarcity frequently prevails. There are many cat-fish in the river, and above Rebucko some other kinds of fish. There are pike, similar to those of Britain, but with scales much larger.

The time of high water, on full and change days, at Walkeria is 10 h. 17 m. a.m. Rise from $16\frac{1}{2}$ to 18 feet or more. Depth at low water, 15 feet: bottom of fine mud. Latitude of the wharf at Walkeria, by two meridian altitudes of Jupiter, agreeing to one second, $10^{\circ} 54' 22''$; longitude by 25 sights \odot W. of ζ , $14^{\circ} 22' 35''$, by 27 sights \odot E. of ζ , $14^{\circ} 15' 15''$: mean, $14^{\circ} 18' 55'' + 3''$ for distance of place of observation, = $14^{\circ} 18' 58''$. The tide at Walkeria runs strongly, and while I was there flowed five hours and ebbed seven; but, during floods in the river (which sometimes rise considerably,) it ebbs or runs down longer.

Walkeria was named from Walker, a slave factor, who realized a large fortune and died here. This place is composed of thatched huts, mostly supported on stakes, though some have mud walls, and there are two of two stories each. The population may be from 500 to 600; all Mandingo Mohammedans, excepting the slaves. *Buoy Modé*, the chief, who speaks a little English, said he had five wives, but he wanted to get some more! His arms bore many *gris-gris* or charms, (they called them gregorys,) and even his horse's neck was loaded with no small number of them.‡

RIVER

* This barrier or rocky dyke is described by Captain Belcher as about half-way up to Walkeria. "It presents the appearance of a basaltic formation, disturbed by igneous action, the sides having a scoriaceous look; and has lifted itself through what is apparently a perfect flat of columnar basalt, but which, under the hammer, proves to be red sand-stone. The dyke itself is a mixture of feruginous sand, with coarse quartz grains and balls of a jaspery nature, forming a coarse conglomerate, exhibiting, both internally and externally, marks of fusion. It is in two pieces, with a gap about 25 feet between; is nearly 50 yards long by two wide, and rises perpendicularly through the disturbed stratum about 8 feet; direction east and west.

† The disturbed stratum is a fine sand-stone, with columns as perfectly prismatic as any basalt ever seen. A little to the northward is another similar formation, but comparatively undisturbed, having only a slightly arched back, presenting the appearance of a carefully paved landing-place. The columns are not above 8 or 9 inches diameter; and some pieces brought away were only 3 to 4 inches, by 5 or 6 long."

‡ The rafters of the roofs of the huts and houses on the banks of the Nunez are of bamboo; but the bamboos are not nearly so large as those of Jamaica.

† King Macandeh and his subjects at Rebucko or Deburko are Kafirs or Pagans. Macandeh is king '*de facto*,' but it is said not '*de jure*.' He is, or has been, an extensive slave-trader. His palaces of mud or earth, baked up into round lumps, then laid one above another, and the interstices filled up with wet earth or mud, well mixed, until the whole wall appears one mass. The palace is two stories high, very prettily situated on a considerable eminence, and commands a fine prospect.

RIVER COMPOONEE.—CAPTAIN BELCHER, in the prosecution of his survey, made out three mouths to the Rio Nunez, and ten miles N.W. of the northernmost, much to westward of where land was expected, saw a cluster of islands, which gradually showed their close approximation to the main, and were ascertained to form the north and west boundaries of the entrance to a river or inlet, larger at its mouth than the Nunez; and, at twelve miles within, the distance to which he surveyed it, deeper, swifter, and promising as large or larger branches. Where Captain B. stopped, it came from the east, and showed several extensive arms leading to the north and west. The entrance by which he ascended has two large channels, equally navigable, but its mouth is so studded with shoals that, until better known, few vessels will probably venture into it; the natives north of the Nunez, having also the general reputation of being dangerous. The western entrance is equally fair and navigable to the sea. The northern alone is very shoal, and probably passable for canoes only: several of these were seen at a distance, and one country schooner;

Circumcision is, so far as I could learn, general among both Mohammedans and Kafirs, and usually is performed at the age of 12 or 13. When circumcised, the children are put into a part of the wood called the *Seymoe*, or *Devil's Bush*, from which they are not permitted to emerge until cured; but there are attendants to provide food for them. There are two seymoe places near Walkeria; one about 150 yards S.S.W. from it, among very large trees, and the other about 300 or 400 yards N.N.E. from it, among much smaller trees. In the latter I understood the children were put, while the former was sacred to the meetings of a secret society which the Kafirs have among them. It is death by the law for an uninitiated negro to enter the seymoe bush; I have been told they would overlook a white person's doing so, but I did not make the experiment. They are also said, "from being so unfrequently trod," to abound with snakes and wild animals.

At the N.N.E. seymoe bush a good many loose stones lay along the river's side, but I could not get one of them for ballast, as the negroes believe that whoever takes any of them will soon die.

There is very little cultivation on the Nunez, excepting some rice, which, unlike that of Carolina and Spain, grows to the very hill tops, and requires no artificial irrigation, and some patches of the *yuca*, or sweet cassada plant. There are but few fruits; the principal are papaws, cashews, wild figs, which, though in shape and flavor resembling cultivated figs, in some degree, grow on a tree entirely different in form and leaves from the genuine fig. Two kinds of plums; one dry and mealy, with a russet skin, (like a French russet apple,) very astringent but not disagreeable taste; another yellow, and of an agreeable sub-acid flavor.

The palm-trees on the Nunez, with their rough scaly coat, are neither so tall or handsome as the smooth barked palm-trees of Cuba, neither is the cabbage at the top of the same shape or appearance.

The *locust-tree*, as soon as the rainy season begins, ripens its fruit, which hang in clusters from the branches like clusters of small beans, and furnish a great part of the negroes' food at that season (say about May). The pods contain small beans, like our horse-beans, or the Spanish algarrobas (carobes); but the most nutritive part consists in a yellow-coloured farinaceous substance, lying in the husks or pods in the interstices among the beans, and indeed imbedding the beans, which resembles flour mixed with honey or sugar, and probably may be the kind of fruit on which John the Baptist fed in the wilderness. The ears of corn plucked by our Saviour and his disciples must have been ears of maize, or Indian corn.

The swarms of wild bees are tormentingly numerous, and when they get irritated, as for instance, when any one throws the rind of a lime into the hive, the empyreumatic oil of which sets them absolutely mad, every one near them must fly, and either escape into a dark place or into a place where there is much smoke.

Considering the immense forest, there are very few birds, but immense numbers of baboons and monkeys, of different species, which make a terrible yelling among the woods on the banks of the river at night. Leopards are pretty numerous, (though I saw none alive,) and there are some tiger and musk cats. There are also, I was told, some deer, but the only kind I saw was a small blueish-grey coloured one, which is tolerably good eating. Some call them the forest goat, (hilotumbo is the native name,) but they are much more like a deer than a goat. There are some elephants near the Nunez. I saw none. Lead balls will scarcely penetrate their hides, therefore the negroes used to shoot them with iron balls; but I am told they now use a sharp iron, shaped like a chisel, with a rod to it, which goes down the musket-barrel to the charge, like a rocket-stick to a rocket. I saw a hippopotamus several times opposite Cassache. [Cassasez?] The head seemed large, out of all proportion to the body, and the legs very short. Although amphibious, they always feed ashore, and are said at times to do great damage to the rice-fields. There are some alligators in the Nunez; I saw one which I am inclined to think was from 17 to 20 feet long.

Among the remarkable animals of the country is a species of ape, without any tail, of which the most marvellous stories are told; but even the well-authenticated ones are sufficiently wonderful. They are described as walking erect, are 4 to 5 feet high, and possessed of wonderful strength and agility. It is said that troops of them sometimes come down on the negro villages, where the inhabitants, not daring to face them, retire to and barricade their houses; and the *Demos* (as they call them) rob their *yuca*-fields, making up the roots in regular bundles, and carrying them away on their heads; as they are also said to do with bundles of locusts or carobes. The leopards also sometimes enter the very villages, and produce great ravages.—A. L.

from which, and the numerous fires at night, it seems likely that the banks are well inhabited, and have some traffic.

Upon a renewal of the Survey in 1832, it was found that small vessels only could navigate this river without great risk, there being a chain of reefs, which nearly bars the passage; but, above this barrier, the channel is sufficiently deep for larger vessels, and has few dangers. The scenery, on ascending, becomes very picturesque; and, in some spots, was even splendid for this coast, where all may be so nearly described as mud and mangrove. The land being *terra firma* in the literal sense, the shrubs were in great variety, and the banks were, in many places, completely guarded by close-set clusters of the pandanus, or screw-pine, a tree not usually considered a native of Africa. On the passage up, several groupes of natives were seen, apparently very timid, and in a state of nature. Judging from the fires in every direction, they seemed to be numerous, and the perpetual sound of tom-toms, a kind of drum, was heard during the night.

At about twenty miles up, and at low water, the stream was found to be brackish, but quite fresh enough for cooking. Ten miles farther it was quite fresh at low, and at 40 miles nearly so at high, water. Alligators and hippopotami were plentiful, with occasional groupes of monkeys. Few birds were seen, and those merely great fish eagles, herons, spoonbill and kingfisher, with occasionally doves and guinea-fowls, heard and seen inland, but beyond reach. On a second night's bivouac the water of the river was found perfectly clear, and the banks of the river also began to show stony landing-places, with grassy points, and but little mud. The course of the river was generally to the northward, and frequently N.W. to W.S.W.*

During the severe service of the *Ætna* on this coast the crew suffered much, and scurvy appeared to enter deeply into their constitutions. Fish diet was found to aggravate this, and the only thing which appeared materially to check the disease was beer, made of the essence of malt and hops. A general use of this on the coast of Africa would be very salutary, and have the effect especially of keeping up the constitutions of men subject to heavy labour in boats. The fresh meat diet, afterward obtained in the Gambia, was of much less obvious benefit than was expected.

THE COAST FROM THE RIO NUNEZ TO THE ISLES DE LOS, &c.—From the Rio Nunez to Sierra Leon, in an extent of about 55 leagues, the coast is, in general, low, in most parts swampy, and intersected with creeks, which, connecting the adjoining rivers, form an excellent inland navigation: but, at unequal distances, from 5 to 20 miles, in a right line from the sea, the land rises gradually; and, beyond that distance, in many places, towers into lofty mountains, which, after a tornado, when the air is pure, may be seen 10 or 12 leagues off.

A small isle, called *Young Gonzalez*, lies about five miles to the eastward from the regular entrance of the Rio Nunez. It is the southernmost of three, having channels communicating with the Nunez, and about five miles true East from it is the mouth of the *River Cappatches*. From Young Gonzalez a long dangerous flat of rocky ledges, gravel, and sand, extends S.W. (by compass) nearly six miles. At low water, a patch, three-quarters of a mile in length, has over it only six feet of water. Its composition is a coarse red sandstone, or conglomerate, like lava till broken. The *Cappatches* is a trading river, but shallow, and frequented only by boats, or vessels not drawing more than four feet of water.

CAPE VERGA, in latitude $10^{\circ} 19'$, is the termination of some moderately elevated land, and not a mangrove island, as commonly described. A long dangerous spit extends from it N.W. $6\frac{1}{2}$ miles. In the deep bay within this no vessels can enter which draw more than 4 or 5 feet of water. This place is S. 21° E., true, from the mouth of the River *Cappatches*.

The coast hence southward appears to be a great series of islands, some forming, others breaking up, so that in twenty years the aspect probably will be materially changed. The high mountains of Cape Verga, which stand about three leagues inland, to the north-eastward of the cape, serve as a mark for it, and may be seen at the distance of 15 leagues. Thus, bearing East [*E.N.E. $\frac{1}{2}$ E.*] are they equally useful to ships bound to the Rio

* On prosecuting the examination it was found that this river is named the *Compoonee*. Captain Belcher has given a pleasing description of its course upward, for which see the *Geographic Journal*, Vol. II. pp. 287, 8. In the upper part many indications of buffaloes, hippopotami, deer, lions, panthers, monkeys, &c. were seen.

Nunez, which, with this bearing, will clear the banks lying without the river, at 5 or more leagues to the south-westward.

Of the mountains within Cape Verga, two, in particular, are the most conspicuous, and the highest, according to M. Roussin, is in latitude $10^{\circ} 18' 52''$, longitude $14^{\circ} 21' 20''$. These mountains have no particular peak, but form nearly one mass, extending from N.E. to S.W., and are about 500 fathoms in height.

RIO PONGO.—The entrance of the Rio Pongo is about 24 miles S.S.E. $\frac{1}{2}$ E. [S.E.] from Cape Verga. The river is well known as a place of trade on this part of the coast, and its consequence has been increased by settlements of slave traders on its several branches. To the country are several entrances, or inlets, but all seem to be included under one general name, *Pongo* or *Pongas*; each is impeded by a bar of mud or sand; and the coasts, to the head of the several rivers, are entirely covered with mangroves.

Captain Belcher says, It is difficult to imagine how the natives exist on the exterior islands between the Nunez [Kakundy] and the Pongas. They are in general populous, and yet do not, for the most part, contain fresh water. The consumption of palm wine on them is great, but this cannot altogether support the inhabitants as drink. The palm-wine is the fermented juice of the head of the palm-tree; and is obtained by driving a hard peg, or boring with a gimblet into this head or cabbage. A stream of liquor flows into a calabash suspended beneath it; and by the time it is filled (about 6 to 8 hours) fermentation has reduced the whole into a milky-tinted pleasant beverage; but the natives generally allow this to proceed too far, when the wine acquires a harsh bitter flavour.

The various uses to which the palm is applied are remarkable. It is truly the natives' friend:—it supplies wine, oil, fishing-lines, hats, baskets, palm-nuts, and, by taking off the head, a most excellent repast in the cabbage, which will feed a family of 10 or 12 persons. Between the young branches, also, covering the cabbage, a fine cotton looking down is found, which, when scraped off, dries almost instantly, and forms an excellent tinder, resisting wet, and used accordingly, to convey fire along the surface of the water, from boat to boat, when fishing. It is lit, and being thrown overboard, is picked up as it drives along: and there are other uses to which different parts of the palm are applicable.

The first of the *Pongas*, or entrances to the *Rio Pongo*, is about ten miles to the south-eastward from Cape Verga. This is called the *Cossencey Bar*, having a shallow and dangerous entrance, though within are 4 and 5 fathoms of water.

The best channel in, for a stranger, is over that called *Rissing Bar*, or the *MUD BAR*, which lies in latitude $10^{\circ} 2'$, and extends more than two miles out from the river to the westward. On the north side of it are only 6 feet, on the south side from 6 to 9 feet, and on the middle 12 feet, at low water. From this bar, two hills up the country, called the *Paps*, bear E.N.E., and serve as the mark for the river. A grove of palm-trees, on the north side, is also a distinguishing mark.

To sail over the *Mud Bar*, get the river open, and steer in N.E. by E. keeping the *Paps*, which are moderately high, a cable's length open of the North point, by which you will carry 4 fathoms in depth at high water, or two fathoms at low water. Anchor in 7 or 8 fathoms, in the middle of the river, abreast the palm-trees on the larboard hand, which trees appear to extend about two miles in length. Then send your boat up the river for a pilot, or fire a gun twice or thrice, at intervals of about an hour, and in all probability a pilot will come off to you.

If bound to this place in the night, approach no nearer than to the depth of 4 fathoms until day-light. If beating in, stand no farther to the northward than to bring the two hills in the middle between the two points of the river; then stand to the southward to 2 and $2\frac{1}{2}$ fathoms, and proceed as shown hereafter.

If going in, with a fair wind, bring the north point of the river, with its palm-trees, to bear N.E., and run in with it bearing N.E. by E. On entering, keep on the south side, within the bar, as the flood-tide sets on the northern breakers. Should you here have a quarter-less-two, you need not fear, as the bottom is all of mud. The river hence lies East and West, about 8 miles, and its depths, in mid-channel, are 3, 4, 7, 6, and 5, fathoms.

The *SAND BAR* is 5 miles to the southward of the *Mud Bar*, and its entrance is more intricate; therefore not to be attempted without a good pilot. This is, nevertheless, the *Mouth of the Rio Pongo*, properly so called. In the best channel, at the entrance, the depth is 12 feet at low water, and within it are 4 and 5 fathoms.

A small sand-bank having showed just above water, at high tide, to the northward of the Sand Bar, and mangroves having taken root on it, the bank consequently increased, and the natives have planted palm-trees on it. There is said to be a passage of 3 fathoms to the northward of this islet.

Vessels bound to the Pongas sometimes make the high land of Cape Verga, and sometimes go to the Isles de Los, for a pilot, although one is not always to be found there. Some run in by their latitude, taking care to sound frequently, as soundings extend out a degree and a half to the westward.

The time of high water here, on the full and change, is 9 hours. The rise about 10 feet.



Sand Bar of the Rio Pongo, N.N.E. $\frac{1}{2}$ E.—A—Barkia Hill; remarkable table land.

Captain Belcher has noticed that the resources offered by the Pongas are few, without proceeding up to a great distance; and even then appear but trifling, and cannot be obtained by money. The trade is confined to rice, skins, bees' wax, cola nut, (African coffee,) gold-dust, a small quantity of ivory, and slaves. Stock is scarce, the water bad; and arms, ammunition, tobacco, and handkerchiefs, are the only equivalents courted. The seine was hauled twice off the entrances with good success; and some varieties of fish were procured not previously known. One was a species between the shark and raia, having the teeth of the latter, but otherwise resembling the former. It is one of the finest fish on the coast; the fin parts, like those of the skate, making most excellent soup; and another advantage is, that it does not decompose so soon as other fish. The cat-fish (*silurus*) was also taken; for, though usually treated with disdain, this is both a well tasted and peculiarly wholesome fish; in proof of which it may be added, that the natives give it a decided preference, and are rather cautious of others.

From the Mud Bar of RIO PONGO to DEMBIA RIVER, a place of some trade, and more to the south-eastward, the distance is 8 leagues. Two leagues to the southward of the latter is *Sangaree River*, whence the land juts out to the S.S.W. true, 6 or 7 miles to *Tumba Point*; beyond which, to the eastward, is the high volcanic land, named *Mount Suzos*; and westward, are the *Ilhas dos Idolos*, or *Isles de Los*, at $2\frac{1}{2}$ miles from the point.

Mount Suzos, properly so named, but which, in the charts, appears under the name of *Sangaree*, has a regular conical peak, excepting that, on its southern side, at half way up, there is a large protuberance. This insulated mountain, in lat. $9^{\circ} 34'$, is a certain mark for the Isles de Los, during the rainy season. In the dry season the atmosphere is always so hazy that the coast of the continent is seldom seen, even near these islands.

At about 4 leagues to the northward of *Mount Suzos*, is another mountain, called the *French Mountain*, to which M. Roussin assigns the lat. of $9^{\circ} 45' 50''$, and long. $13^{\circ} 26' 10''$.

On the 24th of May, 1826, *Captain Owen*, when in latitude $10^{\circ} 2' N.$, saw the *Sangaree* mountains; one formed a sugar loaf between 4,000 and 5,000 feet in height. Having been twelve days in this neighbourhood, on a previous occasion, it may seem strange that it was not then observed; but it was during the dry season, when there is always such a haze over the land, particularly in the day, that the view is always much limited; but in the rainy season every shower clears the atmosphere, and the most distant objects may be discerned.

WINDS, &c.—In March, 1831, H.M.S. *Ætna*, after passing Cape Verga, lost the land-breeze, which had previously blown with extreme regularity from about 10 p.m. till morning, and been calculated on with certainty in moving the ship along-shore. The winds also became much affected by changes in the tides and time of the moon; as, for example, if it were low water at noon, there was seldom wind enough to move the ship till the first quarter flood, and then the tide was too strong to weigh. The weather also became more hazy, so as to prevent the use of the sea-horizon; and for the three days preceding full and change, this was so much the case as inconveniently to shorten the bases of triangulation.

ILHAS dos IDOLOS, or ISLES DE LOS.—These isles, which have already been mentioned, lie between the parallels of $9^{\circ} 25'$ and $9^{\circ} 32' N.$, and between meridians $13^{\circ} 46'$ and $13^{\circ} 52' W.$ They are six in number, but only three are inhabited, the rest being little better than rocks. Those which are inhabited are extremely pleasant, and, in general, healthy. The easternmost island, on which the English factory is established, lies nearly

nearly North and South, with a high wood-crowned hill at each end, which, when seen from sea, appears like two islands. It is $4\frac{1}{2}$ miles in length. The road is on the eastern side; and, during the dry season, is very safe: but, in the tornado and rainy season, there is no security unless in the goodness of anchors and cables.

Tamara or *Footabar*, the largest and westernmost of these islands, is nearly semicircular, rising on both sides from the sea, by a gentle ascent, to a moderate height, and is covered with good timber-trees. It is 5 miles in length, and the summit of its northern part is 465 feet above the sea. That of Factory Island is 470 feet.

M. Golberry says, "The three principal isles of the groupe unite to the advantage of a situation very favourable for commerce, those of a fertile soil and healthy climate. They are exempt from those local diseases produced by stagnant and corrupt water, because they abound in pure and fresh springs: as the soil also rises in hummocks, above the sea, they enjoy those refreshing breezes that allay the heat of the suffocating climate at the rising and setting of the sun.

"The English establishments," he adds, "are conducted with the greatest address. The residences of the commercial agents, &c., are commodious and wholesome; and the magazines, docks, and warehouses, have all requisite solidity."

In a description of the *Idolos* or *Delos Isles*, by the *Baron Roussin*, the admiral says, the isles worthy of description are, *Tamara*, the *Isle Idolos*, or *Factory Island*, and *Crawford Island*, by the French called *Isle Françoise*. *Tumba*, on the East, is so connected to the continent by beds of sand, mostly dry, that it can hardly be considered as an island.

TAMARA, the largest and westernmost island, may be seen in fair weather, at the distance of seven or eight leagues. On approaching, it appears like a range of hills, thickly wooded; its elevation is moderate, and the northern part higher than the south. It is, in shape, like a crescent, with its concavity to the S.E., forming several fine anchorages and depths of 6 to 3 fathoms, at low water.

You may enter the Roadsteads on the eastern side of *Tamara*, either from the northward or southward, only giving the coasts a berth of three-quarters of a mile, beyond which distance both the north and south points are quite clear. A reef, the *Arethusa*, surrounds the north point to the distance of a quarter of a mile. The western side is bold-to, and may be approached safely. *Variation* 18° W.*

Near the principal anchorage within *Tamara* is a spring of fresh water, where eighty hogsheads may be obtained in 24 hours.

At the distance of a mile and a quarter S.S.E. from the south end of *Tamara*, is an islet named *Coral Isle*, leaving a passage between of 9 and 8 fathoms; but, in the same direction, at a quarter of a mile from *Coral Isle*, is a small, but dangerous reef, which must be cautiously avoided.

The central island of the groupe is *Rooma*, or *Crawford Island*, the western summit of which is 300 feet in height. From this island to the N.E. are shoal flats, extending to the distance of 2 miles, toward the north end of *Factory Island*, leaving a channel between of only two-thirds of a mile.

The English establishment now occupies *Crawford*, as well as *Idolos* or *Factory Island*. The resources for shipping at the isles, are abundant and important. Exclusive of wood and water, which may be readily obtained, supplies may be had of cattle, goats, rice, poultry, pumpkins, bananas, oranges, lemons, and citrons. The cattle are small; but the flesh is well flavoured. These articles would be dear enough if paid for in money, but come cheap in exchange for articles of merchandize. The following are sure to be called for: clothes, linen cloth, hardware, gunpowder, iron, fire-arms, brandy, and tobacco.†

CAPTAIN BELCHER (1831) describes the Islands thus:—The Isles de Los consist of three principal islands, *Factory*, *Crawford*, and *Tamara* or *Footabar*, besides several small islets and reefs, inclosing a convenient and safe anchorage for shipping. On *Factory Island* is a

* Survey by Lieut. Jas. Badgley, of H.M. ship *Leven*, 1827.

† "17th January, 1826, at the *Isles de Los*. These islands had recently been purchased by our government, and costly barracks (now almost in ruins) had been built on *Crawford Island*, where there is no water. The soldiers were drawn from the African corps, which is composed of convicts from our regiments of the line," &c.—*Capt. W. F. Owen*.

In 1829 the troops had been withdrawn. Tolerable water might have been obtained from a deep well, but that is much better on *Tamara*.

small factory, which keeps up a communication with the main; the natives thus procuring English goods for rice, wax, hides, a little ivory, bullocks, goats, fowls, yams, pumpkins, cassava, bananas, limes, cola, [the coffee of Soudan,*] pistachio-nuts; and, in the rainy season, oranges, with a few other fruits. Factory Island is well cleared of its woods, but the others only partially so. Good water is to be had on Tamara, and all the islands are said to be healthy, but with something, perhaps, in the atmosphere, or mode of living, which favours the formation of cataracts in the eye, many of the natives being affected with them. Vessels with much sickness on board might certainly resort hither with advantage. The thermometer at noon stands generally at about 82°.

The Isles de Los are of volcanic origin, being formed chiefly of hard blue and iron-coloured lava, with occasional masses of porphyritic hornstone of different elevations. Of the vegetable productions, the most remarkable are the palms, which furnish palm-oil and wine, and the silk cotton tree. The natives also speak of a tree, the bark of which is an excellent bitter; but it was not seen.

The natives belong to the tribes named Baccas or Barkas, [qu. Bagos,] who also occupy other islands along the coast. A great similarity exists between their language and that of the tribes inhabiting the banks of the Nunez.

The rainy season here commences in April and ends in December.

The seasons have here been described as follow. To begin with January—About the 8th or 10th of this month, the *Harmattan*, or cold strong easterly winds, continue, with some strength, for about a week or ten days; after which, the land-wind and sea-breeze take place till about the middle of February, when the wind becomes continual and N.W. or N.N.W., till the last full or change of the moon in March. The tornadoes generally begin and prevail, more or less, till May or June: then the rains set in, and are almost continual all July and August: they begin to abate in September, and go off in October, giving place to the tornadoes, which continue till about Christmas. During the rainy seasons, the winds are mostly between South and West, or in the S.W. quarter; and the tornadoes always blow with prodigious force from the E.S.E., or thereabout, accompanied with thunder, lightning, and a deluge of rain. When a tornado has happened in the night, it is impossible to imagine the clear state of the atmosphere next morning; we have nothing like it in Europe.

Captain Belcher says that the rainy season between the Gambia and the Isles de Los ranges, in its commencement, between the first of April and the first of June; and terminates from the 1st to 31st of December. Off the Conflict reef and Bijoo gas, rains and tornadoes were experienced on the 12th, 14th, and 15th, May, 1831.

The flood, at the Isles de Los, sets to the north. The tide rises and flows, as shown in the Table, page 148. For the positions, see page 29.

COAST between the ISLES DE LOS and the PONGO.—(*Captain Belcher*.)—Tumbo Point is about two miles distant from Factory Island: and is a long rocky flat partly covered at high water, and divided from the main by a narrow channel, navigable for canoes at high water, but nearly dry at low, where the natives affirm that they can walk across, though the depth of mud makes this improbable. From this the main land rises gradually, and partakes much of the features of the Isles de Los, without, however, being quite so denuded or bare as the summit of Tamara. The whole interior is mountainous; the highest peak of which we could obtain a measurement being 2910 feet above the sea. This mountain is called *Kakulimah*. Farther on, the *Sangaree* or *Soomba Ridge* commences, and forms the entrance of the *Sangaree* or *Debrika River*. The highest point of which, *Tikitee-chin*, or, as pronounced, *Tikit-chin*, is 1705 feet above the sea. Its western point is called *Alligator's Point*, and off this the mud extends above a mile, dry at low water.

The whole of this bay is one series of flats and reefs; and no vessel drawing above six feet should venture within a line drawn from Tumbo to Alligator Point. Vessels drawing 15 feet should not, when working up along this shore, do more than open Crawford Island; and, to ensure good room, should even tack when the east end of Tamara opens the south

* The Mandingo name for this is *Gourou*, which they pronounce *Wurru*. It is astringent and bitter, and seems to contain *tannin*. The natives use an infusion of it, which resembles coffee; and as, when eaten raw, it removes hunger, it is carried in expeditions for this purpose. As an article of traffic it is said in some parts of the interior to be worth its weight in gold, being used by the natives whenever they can procure it.

end of Factory Island. Within these bearings the soundings are very regular, and nowhere less than 5 fathoms.

The entrance of the Sangaree River has two fathoms in it; but there is little inducement to ascend it, there not being the slightest trace of trade along its shores, nor any supplies to be procured from them, excepting wood. The water is scarce and bad. The *Ætina's* boat ascended 15 miles.

More to the North there is a small isle in the centre of a river called the Dembia, but which is, in fact, a mouth of the Sangaree. From this isle Alligator Point bears S.E. *true*, $5\frac{1}{2}$ miles. The river will admit very small vessels; but the greatest depth is only one fathom at low water, where the sea curled.

The shores hence are thickly clothed with mangroves, and extend about 16 miles to the first acknowledged mouth of the Pongo, called *Taboury* or *Old Pongo*, which is bordered to a mile out by dangerous breakers.

DIRECTIONS FOR SAILING FROM CAPE ROXO TO THE ISLES DE LOS.

By the Baron Roussin.

The description of the Bissagos, already given (page 318) points out the course to be steered in order to double their S.W. extremity. A vessel starting from a point at $4\frac{1}{2}$ leagues to the westward of Cape Roxo, which will be a little without the meridian of $17^{\circ} 0' 0''$ W., to the parallel of $10^{\circ} 40' N.$ will be outside of all the dangers. From hence a course S.E. $\frac{1}{2}$ E. [*S. 68° E.*] and distance 68 leagues, will lead her to the west point of Tamara Island. On this course the soundings will never be under 8 fathoms, until near the shore of the Island; and those on the first course will be considerably more.

From the parallel of Cape Roxo to that of the western breaker, $11^{\circ} 31' 32'' N.$, at a distance of more than 4 leagues to the westward of the meridian of $17^{\circ} 0'$, the depth will increase progressively from 8 to 28 fathoms, and the bottom be entirely of mud. This remark may be depended on to show that a vessel is not far to the southward of the parallel of the Jeba or Great Channel; she cannot at the utmost be more than 10 miles from the positions already given. From this point, as far as the parallel of $10^{\circ} 40' N.$, the bottom is nearly free from mud, and on passing to the southward of the parallel of $11^{\circ} 20'$ very slight traces of it remain, but are succeeded by a bottom of fine white sand, sand and gravel, sand and broken shells, with a depth varying from 12 to 50 fathoms. A vessel, having left Cape Roxo, and arrived in latitude $10^{\circ} 40'$, may thence steer a direct course for the Isles de Los.

The S.W. edge of the Bissagos follows a gentle curve from the western breaker as far as the southern one, that of La Bayadere. The bottom, in this part, presents a singular peculiarity. Amongst the fine white sand, sand and broken shells, sand and gravel, of which it is most frequently composed, a greenish-coloured sand is sometimes found. The depth decreases very gradually from 50 to 9 fathoms, from S.W. to N.E.

The remainder of the course to the Isles de Los passes over deep soundings, as much as 50 fathoms, at the point of departure, and the least depth is 12 fathoms. No precise rule can be given as to the changes in the depth along this track, nor as to the various nature of the bottom. It is known only that the ground, in the space passed over by this course, seems to be furrowed with channels, which, commencing from the southern extremity of the Eastern Channel of Bissagos, diverge toward different points between *S.W.* and *S.S.E. true*. The furrows above-mentioned appear to have been caused by the regular tides in the mouth of the Rio Grande, and prove, beyond a doubt, that the outlet of the same channel is partly caused by that river. With respect to the nature of the bottom, M. Roussin says that he remarked the total absence of mud. The bottom is of fine sand, in some places mixed with broken shells, small pieces of brittle rock, and gravel, which appeared to be only a covering to beds of a whitish volcanic sandstone, into which the lance penetrated but three or four inches, and did not hold. A muddy bottom is not found until about 10 leagues to the westward of the Isles de Los, and then only in small quantity, till within a very short distance to the N.W. of those Islands.

TIDES.—In proportion to the distance from the mouth of the Jeba or Great Channel of Bissagos, either to the northward or southward, the tides lose their regularity. This interruption in the tides is evident in going to the southward, as, at a few miles south of the parallel of the western breaker, $11^{\circ} 31' 32'' N.$, they are no longer perceptible, even on the edge of the Bissagos.

No decided course of the current was ascertained to exist, but it is generally allowed that the waters have a greater inclination to flow to the southward than to the northward; and it may be presumed that it follows the direction of the winds on the western edge of the Archipelago, but it is seldom found to be considerable.

ISLES DE LOS TO SIERRA LEON.*—DESCRIPTION and DIRECTIONS by Captain THOS. BOTELER, of H.M.S. HECLA, 1829.

The portion of coast between the Isles de Los and Sierra Leon comprises an extent of 66 miles, and contains several rivers, islands, and banks, besides various inconsiderable creeks.

Between the ISLES DE LOS and the sharp low point of Tumbo, there is a safe channel, through which, by Captain Owen's charts, ships may carry 3 fathoms of water, and which may be at times highly convenient to use, or even to run through the groupe; yet, without some good reason for so doing, it will always be adviseable to go outside the islands, where certainly no dangers are to be met with.

In approaching this part of the coast, it may be remarked, that though the three-fathoms' boundary, in some places, extends to a considerable distance, yet the soundings are so regular as to give ample warning. A tumbling sea at times may prevail in a strong breeze, yet, as no gales but the *TORNADOES*, which are of short duration and off shore, are known upon this coast, a commander need never be alarmed; for there is always good anchorage under foot, and no long swell current to force the vessel into danger.

From *TUMBO POINT* to *MATACONG ISLAND* the bearing and distance are S.E. by S. 23 miles. Tumbo Point is the S.W. extremity of an island bearing the same name, and separated by a very narrow high water channel from the main land. To the southward of this point, the land falls back to the north-eastward about 7 miles, forming an extensive but shallow bay, at the bottom of which is an inconsiderable stream, called *Tännaney River*, accessible to canoes only.†

In the extensive bay between the Isles de Los and Matacong Isle, no detached dangers exist. The coast is safe to approach, the soundings being gradual, and always affording good anchorage; and it is in all parts accessible to large ships to the distance of 6 miles, which generally may be considered sufficiently near to distinguish the land, and often to recognise the mouths of the rivers.

MAHNEAH RIVER, about 12 miles E.S.E. from Tumbo Point, is, at low water, scarcely accessible to the smallest coasting vessels, but the rise of tide exceeds 2 fathoms. The entrance is about six miles south-eastward from that of Tannaney, but the water between is very shallow; and a mud-bank, which extends south-westward from the west point of the entrance, is uncovered at low water, more than two miles from that point. A similar mud-bank lines the east side also, leaving the channel between above a mile wide, but carrying only from 4 to 8 feet at low water.

To enter this river, it is necessary only to bring the western point of the entrance, while at the distance of 5 miles from it, to bear N.E. by E. $\frac{1}{2}$ E., and then steer toward it in that direction, until you get close to the S.W. mud-bank, when you may proceed along by the edge of that bank, in a convenient depth, according to circumstances. Within the River, the depths at low water are from 6 to 10 feet only.

The water discharged from this river must be very great, as the ebb tide runs out with great rapidity.

RIVER MOREBIAH.—The mouth of this river is about 18 miles S.E. by E. $\frac{1}{2}$ E. from the Isles de Los, and about 7 miles northerly from Matacong Island; and, though its breadth within the points no where exceeds half a mile, yet it is far superior to the Mahneah last described. Its entrance is narrow, and forms an elbow at the commencement, which, to render perfectly safe, would require *two buoys*, because the coast is destitute of good objects to serve as marks.

* See Chart of this Coast from the Isles de Los to Sherboro Island, published at the Hydrographic Office, and corrected to 1830.

† See Chart, with the entrances of the Tannaney, Mahneah, and Morebiah Rivers, by Captain Boteler, published at the Hydrographic Office, 1830.

In approaching the coast abreast of the river, with its opening bearing E.N.E. $\frac{1}{2}$ E., distant about nine miles, and Matacong Island S.E. by E. $\frac{1}{4}$ E., you will have 6 fathoms of water on black mud; from this situation, the depth will decrease gradually, on a bottom of the same kind, to $3\frac{1}{2}$ fathoms at the entrance of the channel. With the rounding of the land between the rivers Mahneah and Morebiah bearing N.N.E., the east point of the entrance E. $\frac{3}{4}$ N., and the middle of Matacong Island S.S.E. $\frac{3}{4}$ E., you will have that depth, and be at the spot marked with an *anchor* on the plan. From this position, steer N.N.E. until the east point of the river bears E. $\frac{1}{4}$ S., and then stand in toward this point, or about East; but remembering that, both flood and ebb set partially over the extensive shoals that form the S.E. side of the channel: some of these, however, being dry at low water, and nearly so at high water, their steep boundary is perfectly discernible. In the elbow of the channel, the least depth is $1\frac{1}{4}$ fathoms at low spring ebbs: this depth, however, continues but a short way; and, from the time of altering your course to the eastward, or steering straight in, you will seldom have so little as 2 fathoms. Beyond the east point, the depth varies from 4 to 6 or 7 fathoms, and for the extent of 7 miles up the river, it appeared to be clear of all danger.

About four miles above the east point of this river, and on the same side, a remarkable round mass of granite rock rises abruptly, about 40 feet from the water's edge; it is about 400 yards in circumference: others may be seen inland; and the natives assert that several are scattered about as far as the *Sangaree Mountains*, which, they say, are also of granite.

It is high water on full and change days at 7h. 40m., and spring tides rise 11 feet.

The contrast which this coast presents to the eye in different states of the atmosphere, has been already noticed in pages 101, 102, and 333.

MATACONG ISLAND.—The beauty of this island consists of the luxuriance of the trees, the verdure of those spots which have been cleared away, and the gentle rise, which renders it a conspicuous contrast to the low swampy tract opposite. It is more than a mile long, and having been purchased from the natives, by Mr. Gabadon, a merchant of Sierra Leon, is now established for rearing cattle. The island appears to be of lava, yet on its summit there are two large pieces of granite; but there is reason to believe that they have been artificially placed there.

Matacong is surrounded by mud-banks and rocks in all directions, so that no vessel of any burthen can lie at anchor within two miles of it. The channel which divides it from the main is nearly three-quarters of a mile broad, but its muddy bottom, at low water, is left dry.

From MATACONG ISLAND to SALLAHTOOK POINT, a distance of $14\frac{1}{2}$ miles S. $\frac{3}{4}$ E.,* the general features of the coast are the same as those already described, but the mountains are too distant to be distinctly seen; here and there a *Cotton Tree*, with smooth trunk and spreading foliage, rises above the surrounding thickets, and serves to identify the locality of the coast to those who are acquainted with it; but a stranger can make the mouth of the river which he intends to enter, by his latitude only, or by running the coast down from some known point.†

From Matacong Island, the coast trends to the eastward a little more than 3 miles, where it turns abruptly to the northward, and forms the west point of the mouth of the RIVER FOREECARREAH: the interval being fronted with sand and mud banks, which extend more than three miles to the southward. The entrance of this river is above two miles wide, and the least depth is one fathom at low spring ebbs. To sail in, it will be necessary to pass close to the banks which project from the west point, but at the same time to be cautious in approaching them, as they are steep-to, and dry at low water. The outer sand will be apparent, even in fine weather, at any other time than high water, and if seen, it may be safely skirted in two fathoms near low water, or in 4 at high water; and that you may not get in at the back of this sand, do not bring the highest part of Matacong Island to the west-

* See Chart, with the entrances of the Foreecarreah, Mellacoree, and Tannah Rivers, by Captain Boteler, published at the Hydrographic Office, 1830.

† In the Table of Positions, page 29, the position of Matacong or Matagong is given according to Captain Owen, &c., in lat. $9^{\circ} 14'$ and long. $13^{\circ} 25' 30''$; but Captain Boteler (1829) gives the house on the north side of the same island, in latitude $9^{\circ} 16' 10''$ and long. $13^{\circ} 26' 20''$; and hence, by survey, the latitude of Sallahtook Point will be $9^{\circ} 3' 5''$.

ward of N. by W. $\frac{1}{4}$ W. until the west point of the river bears N.E. $\frac{1}{4}$ E. You may then safely enter, recollecting, as a guide, that you should always keep the western side aboard, off which, however, you will have to edge occasionally to avoid the banks; yet this river is of very little consequence, as a ridge of rocks nearly crosses it at a short distance from its mouth. The ebb tide here is extremely rapid, and the overfalls in the vicinity of the rocks are dangerous to those who do not possess a local knowledge of the river.

The RIVER MELLACOREE, which is at present of considerable importance in the timber trade, has better objects for marks than any of those already described, and the facilities of its navigation are greater, yet buoys are indispensably requisite to make this secure.

For *Entering the Mellacoree*, observe that, at eight miles off shore there are 6 fathoms of water; and, with the River's Mouth bearing E. by N., it will be fairly open. Steer toward it, in that direction, until the soundings have decreased gradually to about 3 fathoms, at low spring ebbs, with the following bearings; East Point of Yellaboi Island, S. by E.; Sallahtook Point, distinguishable by the trees being higher than elsewhere, bearing S.E. $\frac{1}{2}$ S.; Bentee Point,* known by a remarkably large tree, E. by N.; the outer Point of Tannah River, E.N.E. $\frac{1}{4}$ E.; and the rounding of the land to the northward of the River N.E. $\frac{1}{2}$ N.; you will then be at the spot indicated by the outer *anchor* in the plan, and in the fair way. The MIDDLE GROUND is steep and dangerous, but the soundings on the southern side are gradual, though the mud-bank is very wide; borrow, therefore, rather on that side until nearly as far as Bellangsang Point, when you must haul over to the mouth of Tannah River and there anchor. Higher up, there are some patches of rocks in the middle of the river, but at low water they are seen, as well as the deep water channel between them, which is one third of a mile in breadth, with a depth of 7 to 9 fathoms. By keeping the East Point of the River Tannah, bearing N.W. by W. $\frac{1}{4}$ W., you may pass through this channel in safety; and, there being no further danger, you may ascend the river to the factories established below Devil's Island, on the south shore; the general depth varies from 5 to 9 fathoms. Here it is high water on full and change days, at 7 hours, 40 minutes; spring tides rise 11 feet.

Besides the channel on the south side of the Middle Ground, for which directions have been given, there is also an inferior one to the northward; to enter which, when 5 or 6 miles off shore, bring the west point of Tannah River to bear E. $\frac{3}{4}$ S., and by carefully using the lead, you may proceed in with safety; for although at its termination it takes a slight turn round the N.E. corner of the Middle Ground, yet this is generally so well indicated, that you can scarcely be deceived.

The TANNAH RIVER, which falls into the Mellacoree, is also navigable, though much smaller, and the tides are not so strong as in the main stream.

On account of the soft nature of the bottom, vessels may ground in several places in the vicinity of the Mellacoree River without being injured; but a patch of foul ground which surrounds the long reef off Sallahtook Point, must be carefully avoided.

COAST FROM SALLAHTOOK POINT TO BALLO POINT.†

From SALLAHTOOK Point the coast trends S.S.E. 7 miles, to a small river, on the western point of which is situated Sängähtook Factory; and about $1\frac{1}{2}$ mile to the westward of this point is Yellaboi Island, surrounded by mud-banks that are dry at low water.

YELLABOI is a low swampy island, nearly two miles in length, and covered with trees, which, toward its western extremity, give it the appearance of an abrupt cliff, easy to be recognised; abreast the S.E. extremity of the river, there is another small river called Inglis Pähböyſäh.‡

* This point is on the south side of the river, and immediately opposite to another point, on which there are two very large trees.

† See Chart, with the entrance of the Scarcies Rivers, by Captain Boteler, published at the Hydrographic Office, 1830.

‡ Yellaboi or Yelleboa, according to Captain Owen, as shown in the Table, page 29, is in latitude $8^{\circ} 55' 42''$, long. $13^{\circ} 17' 45''$. Captain Boteler gives its west end as in lat. $8^{\circ} 57' 5''$, long. $13^{\circ} 18' 25''$. Variation $13^{\circ} 4' W.$ 1829.

CORTEEMO ISLAND.—Four miles S.E. from Yellaboi we come to a much larger island, with extensive mud-banks to the north-westward, but with a deep channel between it and the main; it is called *Cörtēmo*, and lies in the mouth of the *Rivers Scarcies*. These rivers are known on the coasts by the names of *Great* and *Little Scarcies*; the former is navigable for large ships, but the other is adapted to very small vessels only, and requires very careful pilotage.

GREAT SCARCIES.—The channel into the Great Scarcies River is the best on this part of the coast; for, although the banks are steep, yet it is broad and deep, and a ship of the line, by taking a proper time of the tide, might moor off the inner point of Yellaboi Island.

To sail into this anchorage, bring the west end or highest part of Yellaboi Island to bear E.N.E. and steer toward it in that direction, until you decrease the depth to 5 or 4 fathoms, which will happen suddenly. Now change the course, and keeping in 4 to 5 fathoms, steer direct for *Inglis Pahboyeah River*, bearing E. $\frac{1}{2}$ N.,* taking care to keep it well open of the inner point of Yellaboi Island, until the west point of that island bears N. by E. $\frac{1}{4}$ E., when you must haul directly in toward it, and skirting along the steep mud-bank which borders the south side of the island, steer for its S.E. point, close to which you may anchor in $4\frac{1}{2}$ fathoms. In reaching this anchorage the least depth you will have to pass over, will be $2\frac{1}{2}$ fathoms at low spring ebbs; and this occurs only after hauling in for the island, and running along the edge of the mud-bank.

A timber ship lying at this place, could easily have her cargo rafted down to her, excepting during the *rains*, when, as affirmed, the strong winds occasion so heavy a sea, as to make it unsafe to lie there with her raft ports open. With little difficulty, however, she might proceed to Kakongkah Island; though the channel is narrow and crooked, and would perhaps require buoys to point it out.† It would be scarcely possible to give intelligible marks for this winding channel, but it is so apparent in the plan, that by using the boat a-head and never passing over the 3 fathoms boundary line described therein, except in crossing the three short flats, you can scarcely go wrong; the bottom, however, is so soft, and the water so smooth, that no damage will arise from touching. It is high water here on full and change days, at 7 h. 10 m., and spring tides rise 11 feet.

For Captain Boteler's General Remarks on the Coast and Seasons, see page 101.

DIRECTIONS FOR SIERRA LEON, &c.

From *Yellaboi Island*, mentioned in the preceding page, the CAPE OF SIERRA LEON bears S. by W. $\frac{1}{4}$ W. [*South*] 25 miles. This cape, with the coast eastward, forms the south side of the great river, bearing the same name.

The coast northward of the mouth of the river is low and level, bordered with a shoal bank three miles in breadth, and which has upon it several dangerous rocks; but, on the south side the land rises into hills, which, forming one upon the other, tower into lofty mountains, crowned with perpetual verdure. These are, properly, the *Sierra Leon*, or *Lion Mountains*, which have given name to the river and country. From the foot of the hills, points of land, projecting into the sea, form excellent bays for shipping and craft, and convenient places for hauling the seine.

The mouth of the river, which is two leagues wide, is obstructed by an extensive bank, called the *Middle Ground*, but, on the south side of this is a safe and deep channel for vessels of any burthen. The latitude of the cape, as shown in page 29, is $8^{\circ} 30' N$.

Vessels bound from Cape Verde to Sierra Leon are recommended to gain soundings in latitude $9^{\circ} 15' N$. on the grand bank which extends from the Bissagos to Cape St. Anne; and having gained bottom in 50 fathoms, gray sand, on the edge of the bank, to make a true S.E. by E. course, keeping in soundings until in latitude $8^{\circ} 29'$ or $8^{\circ} 30'$. Then make an *East* course good, and you will make the land of Sierra Leon, the mountains of which may be seen, in *clear weather*, 14 leagues off: but as, on this coast, the weather is generally hazy, it is seldom seen farther off than 6, and frequently not more than 4 or 3,

* Of *Inglis Pahboyeah River* the entrance is nearly a league to the north of Corteemo Island.

† *Kakongkah* is a small isle in the mouth of Great Scarcies River, having a factory near its western extremity.

leagues; although, at the same time, a good observation may be had. This is occasioned by the constant vapours, caused by the sun, which ascend from the mountains, covered with thick woods.

Appearance of Cape Sierra Leon, bearing S.E. by E. distant about 5 leagues.



In standing in for soundings, and approaching Sierra Leon, keep the lead constantly going, as the current sets in various directions, but generally tending to the eastward. It is requisite to be very attentive to this particular. Should you be standing in, in the night, in lat. 8 deg. 30 min., and shoalen your water from 20 to 18, 13, and then suddenly to 8 and 7, fathoms, you will be at the distance of 3 leagues from the river, and should immediately anchor, and remain till day-light.

The danger on standing in for the cape is, the *Middle Ground*, hereafter described, which extends seven miles from the eastern shore, and nearly to the meridian of the cape, leaving an entrance only two miles broad. Having made the land of Sierra Leon, bring the cape, which may be easily known by a small negro town standing upon it, to bear S.E. by S., then steer directly for it. At this place pilots for the river may be had.

A Rock, called the *Carpenter*, lies at the distance of nearly a mile W. $\frac{1}{4}$ N. [*W.S.W. $\frac{1}{2}$ W.*] from the N.W. extremity of the cape. This rock always shows itself by the breakers over it, and at half-tide may be distinctly seen. The flood-stream sets directly through between the cape and the rock. You may advance within half a mile of the rock; but those beating down the river, with the sea-breeze, and a strong ebb-tide, must be careful, and give it a good berth, as the ebb-tide sets strongly between the rock and the cape. From the cape a ledge of rocks extends in a direct line toward the Carpenter.

Within the cape the general trend of the coast is nearly true East, 6 miles, but it is broken by several inlets, which are called *Bays*. Of these, the first within the cape is a small cove, of pleasant appearance, called *Cape Bay*; the next is *Pirate's Bay*, so named from being the place where the pirates formerly used to careen and refit their vessels; the third is *Whiteman's Bay*; the fourth *St. George's* or *Freetown Bay*, whereon stands FREETOWN, protected on the hill-side by a fort, and above the fort, on the summit of the hill, are the new barracks. On the east of Freetown is *Susan's Bay*, and at a mile eastward of the last is *Thompson's Bay*, bounded on the east by Farran Point. For Freetown, see the note 10, on page 32.*

The

* However pernicious the climate, and very pernicious we know it to be, to the European constitution, the country about Sierra Leon is most beautiful. The following description is from a letter written in 1828. It may be flattering, but still useful.

The entrance of Sierra Leon River, the full view of the town and the Bullom shore opposite, and the magnificent, I may almost say sublime, back-ground, are very striking to the eye of a stranger first approaching this spot by sea. The anchorage is good, and capable of accommodating a large fleet of ships. The export trade, though not very considerable, is rapidly increasing, consisting principally of African timber, gold dust, elephants' teeth, hides, palm-oil, honey, wax, arrow-root, and pepper. The imports are almost universal and solely from England. I have no doubt, judging from the goodness of the soil (which I have closely examined in my rides, and of which my quondam farming pursuits, I may flatter myself, have rendered me a not incompetent observer,) the reasonable industry of the black people, whose anxiety to be located upon land of which they are to possess the title-deeds, and from the experiments which have been already made in agriculture here, that the day is not far distant when this peninsula will produce coffee, indigo, and grapes, in great abundance. The coffee is uncommonly fine, the indigo good, and the grapes of a remarkably rich flavour. The establishments of the principal inhabitants in or near the town are handsome, large, and in every respect suited to the climate, and most of them present pretty country seats, with gardens and grounds. The middle classes hold good and commodious houses, and the labourers' cottages or huts bear comparison with those of England. Then the everlasting rich foliage is most delightful; equally overshadowing the habitations of the rich and poor. Plantains, pines, bananas, oranges, and limes, may be bought in the highest perfection at little cost. I am much struck with the constant busy occupations of the liberated Africans; whether labouring in the town or fields, they are seldom idle. How erroneous are the notions entertained respecting this race of men, amongst even well-informed persons at home! It is true they do not work so hard as the English peasantry in mowing or reaping. In this climate would you have them work so severely, and with such little intermission? But they do so much within the twelve hours as to enable them to maintain themselves and their

The *Middle Ground*, already mentioned, forms the north side of the channel into the river, which is half a league in breadth. The general depths in the channel are from 6 to 10 and 12 fathoms. From the cape the extremity of the *Middle Ground* bears N.E. $\frac{1}{4}$ N. [*N.N.E.*] two miles, and the bank extends thence eastward to the *Bullom* shore. The ground is, in general, composed of hard sand; and, in some part, large stones. It dries, in several places, at about the middle of half-ebb; and, at all times, the sea breaks over it. On its eastern part there is a channel, but it is fit for small vessels only.

The *Bullom shore*, which forms the north side of the entrance of the river, is level and covered with wood. On this shore, in latitude $8^{\circ} 40'$, is an islet, called *Leopard Isle*, whence the coast rounds to the south-eastward, nearly 12 miles, to *Tagrin Point*, and between are eight negro towns, of which the fourth, from the northward, is that of the King of *Bullom*. The edge of this coast is low, swampy, and bordered with shoals. In the river eastward of *Tagrin Point*, is *Tasso Island* and several smaller isles, the formation of which can be understood only by reference to the particular chart.

Ships from the northward, when bound to *Sierra Leon*, should be careful how they approach the cape. They must keep their lead going, and not approach any nearer than 6 fathoms, until they see the high land. No one should stand in for the cape until he gets that high land to bear E.S.E. $\frac{1}{4}$ E. [*East*] and, when he is six leagues off, he will see the cape making in a small low point, with a ridge of coco-nut trees close to the water's edge; and, when within 3 leagues of the cape he may observe the *Carpenter Rock*, with the sea constantly breaking over it. You pass the cape within a quarter of a mile, in 9 or 10 fathoms. You will now open the first cove, called *Cape Bay*, and thence pass *Pirates* and the other inlets which have been described. In all these bays excellent fish may be caught with the seine, and sometimes green turtle.

Having passed the cape as above, your course will be S.E. by E. $\frac{1}{2}$ E. [*E. $\frac{3}{4}$ S.*] up the river; this leads clear along shore to *Freetown*, which is $3\frac{2}{3}$ miles from the cape. The general depths will be 12 to 18, 13, and 14, fathoms. In working to the northward, advance no nearer to the *Middle Ground* than in 7 fathoms.

To anchor off *Freetown*, bring the fort (*Fort Thornton*) to bear S. by W.; the East point of the bay S.E. $\frac{1}{2}$ E.; King Tom's or the west point W. by N., off shore one quarter of a mile, 15 or 16 fathoms, with mud. Moor with the best bower to the eastward. The watering-place here is very convenient, and the water excellent. You fill your casks in the boat, with a hose, which leads from a cascade.

In sailing up beyond *Freetown* to *Farran Point*, or farther eastward, you will find regular soundings, 14 to 16 and 17 fathoms. You may make free with the shore all the way up, as it is very bold.

Farran Point is remarkable. It is elevated and has a house on its summit. In hazy weather, several vessels, on coming in, have mistaken this point for *Cape Sierra Leon*, although it is nearly two leagues eastward from the cape, and have thus touched on the *Middle Ground*. But *Farran Point* serves as a good mark for the mid-channel between the *Middle Ground* and *Carpenter*, when kept well open to the north of the cape, and bearing S.E. by E. $\frac{1}{2}$ E.

Vessels coming in more from the northward will clear the west end of the *Middle Ground*, in $3\frac{1}{2}$ fathoms, with King Tom's Point (west of *Freetown*) on with the central barrack, bearing S.S.E. $\frac{1}{4}$ E. [*S.E. $\frac{1}{2}$ E.*]

their families in comfort, and lay by something besides. The colony has been more healthy during the last than in any previous year. I ride and see every thing that is worthy to be examined within ten miles of *Freetown*. It is observable that the people readily submit to a due exercise of authority, and really seem to show that they like to be governed, &c.

In 1826 Captain Owen estimated the population at about 20,000; but, as he observed, the liberated males, of the negroes, exceeded the females by, at least, five to one, so that there was no probability of a speedy increase.

The towns, or rather villages, inhabited by the liberated slaves under the direction of Church missionaries from England, are named *Gloicester*, *Bathurst*, and *Leopold*. These places are situate more than 1000 feet above the sea, yet in the most sultry part that could have been chosen, being a deep valley surrounded by lofty hills, which reflect the sun's rays, and interrupt the free current of air, so essential to health.—(*Capt. Owen.*)

The *Tide*, at Freetown, flows on the full and change days, at 7 h. 50 m., and rises $12\frac{1}{2}$ feet.

During the rainy season, the tide is very regular and strong, running 6 and 7 knots an hour, and the ebb sets rapidly on the Middle Ground. In the dry months, it commonly flows on shore at 7 h. 30 m., with $7\frac{1}{2}$ hours ebb, and $4\frac{1}{2}$ flood. In this season, the ebb runs $2\frac{1}{2}$ miles an hour, the flood only 2.*

SIERRA LEON to CAPE ST. ANNE, &c.—From the Cape of Sierra Leon the coast, at the foot of the mountains, forms a slender sandy bay, bordered with trees, which extends more than three miles to the southward of the cape, where it terminates in a rocky point. At three-quarters farther is another point, more conspicuous and projecting, named the *False Cape*. The last bears from Cape Sierra Leon S. by W. $\frac{1}{2}$ W. [S. $\frac{1}{4}$ E.] distance 4 miles.

From False Cape to York, or the Sisters River,† the coast trends irregularly S. $\frac{3}{4}$ E. [S.S.E. $\frac{1}{2}$ E.] 12 miles; and from York to Cape Chilling, S. $\frac{1}{2}$ W. [S. by E.] 7 miles.

At Cape Chilling, the hills of Sierra Leon terminate, after having made a high double land, which is seen a great way off; the mountain near the south is of a prodigious height, its summit being perpetually covered with clouds, and can be perceived at the distance of 14 or 15 leagues. The cape itself is low, and covered with trees; and, at 4 or 5 leagues off, appears like a small island.

One of the boats employed in the survey under Captain Owen was driven on rocks extending from Cape Chilling, and was totally destroyed, the people, with great difficulty, being saved. Upon this cape is *Kent Town*, a village of liberated Africans and disbanded negro soldiers, having a school composed of 164 boys and 70 girls; but, as no sure market exists for their industry, they raise little from the soil except for their own use. This village is delightfully situate on the side of a hill, with a large house for the superintendent, who is also schoolmaster. He resides on the first floor, the lower part being made use of as a church.—*Capt. Owen*, 1826.

BANANAS.—Off Cape Chilling, and separated by a space of 2 miles in breadth, lie the BANANA ISLES. The outer or S.W. end of these isles is 7 miles S.W. by W. $\frac{1}{4}$ W. [S.W. $\frac{1}{2}$ S.] from the cape. The greater part of their coast is foul and rocky.

The Bananas very much resemble the Isles de Los, but the land is more elevated. They are extremely fertile, and have plenty of water, but no running streams. Wild cattle are abundant upon the greater Isle. It is a remarkable fact that pigs are the only domestic animals that cannot be propagated here; as there appears to be some herb, of which they are inordinately fond, but which is fatal to their existence.

A few years ago H.M. ship *Tartar* anchored off Cape Chilling and to the northward of the Bananas, with the N.E. point of the isles S.S.E. $\frac{1}{2}$ E. and the western part S.S.W. Between the ship and islands the water deepened to 8, 9, and 7 fathoms; but within a cable's length of the shore, between the westernmost island and the next, there was found a depth of only 2 fathoms. The westernmost islet was then inhabited by only one Frenchman, *Jean Baptiste Major*, and his four slaves.



The Bananas appeared as above, from the *Tartar's* anchorage, at the distance of 4 miles.

There is anchorage as well to the southward as to the northward of these isles, but the best is said to be in 5 fathoms about 2 miles from shore, on clear clayey ground with the N.E. point S. $\frac{1}{2}$ E. and the highest hill S. by W. $\frac{1}{2}$ W. There are sandy bays, which may be seen from the anchoring place, and where you may land; but the best is at the S.W. end. Wood and water are obtainable here. The watering place, which is close to the beach, has a very good run of water.

* Directions for sailing from the Bight of Biafra to Sierra Leon have been given in treating on the Currents, page 179.

† Otherwise *Agaltoopant*, or River of the Twin Sisters.

Mr. Woodville has said, "It is very evident that the whole chain of mountains called Sierra Leon, as well as the Isles Bananas and the Isles de Los, are the productions of volcanoes; if we are to judge from the great quantity of lava found there, and from the small pieces of it taken up by the lead, in sounding, at certain distances from the land, opposite to these islands, and no where else; also from the conical figure of many of the hills, and from the ferruginous soil in the country."

YAWRY BAY.—At 6 leagues S.S.E. [*S.E.* $\frac{1}{4}$ *S.*] from Cape Chilling is *Point Tassa*. The coast between forms *Yawry Bay*, the shore of which is bordered with a shoal 4 miles broad, having on it many oyster beds. Great part of the bank is uncovered with the ebb, and has only 4 feet over it at high water.

Off Tassa Point is a group of islets and rocks, called the *Plantain Isles* and *Bengal Rocks*, which extend from the point 5 miles westward, on the flat between Yawry Bay and Sherbro Inlet.

TIDES.—The Tides divide off the False Point of Sierra Leon. To the northward of that point the flood runs to the northward; to the southward of that point it sets to the south. Hence, at the Bananas the flood is from the N.W., and the ebb contrary. Here the tide flows, on the full and change days, at 8h. 15m. During the equinoxes it rises 9 or 10 feet perpendicular; other spring tides 8 or 9 feet. At the Plantain Isles it rises about a foot and a half more than at the Bananas; but, at the Bashaw or Turtle Isles, more to the southward, the rise is 6 or 7 feet, common spring tides.

SHERBORO INLET.—The Inlet or Sound of Sherbro, commonly called Sherbro River, is between the island of that name and the main land. The westernmost headland of the island is *Cape St. Anne*, in latitude $7^{\circ} 34'$, and nearly on the meridian of Point Tassa, which lies in lat. $7^{\circ} 55\frac{1}{2}'$.

From *Point Tassa*, the coast, forming the north side of SHERBORO INLET, trends $12\frac{1}{2}$ miles S.S.E. $\frac{1}{2}$ E. [*S.E.* $\frac{1}{4}$ *E.*] to the mouth of a river, the *Yallucka*, and thence it winds to the south-eastward, 6 leagues farther, to the *Bagroo River*. It is bordered by a mud-bank, off which are several shoals, the positions of which can be understood only by reference to the particular chart.

The south shore of Sherbro Inlet is the north shore of Sherbro Island, which is 8 leagues in extent, from *Cape St. Anne* on the west to *Jamaica Point* on the east. On this shore, at $12\frac{1}{2}$ miles eastward from Cape St. Anne, is the spot and remarkable tree called *Little Pow Grande*, and at $3\frac{1}{4}$ miles more to the east is *Pow Grande*. At a league and a half eastward of Pow Grande, on the shore, is *Jenkins' Village*, off which is the general roadstead for large vessels, having 5, 6, and 7, fathoms of water. All the shore between this and Cape St. Anne is bordered with an extensive mud-bank.

BASHAW or TURTLE ISLANDS.—On a great flat, which extends more than 4 leagues to the N.W. from the western end of Sherbro Island, is a group of eight or nine islets, called the *Bashaw* or *Turtle Isles*, which are evidently the remains of a considerable tract of land now submerged by the sea. The bank on which they exist also exhibits innumerable ridges, knolls, blind channels, and pools; but is navigable on almost every part by large boats at high water, and at low water by light boats and canoes.

DIRECTIONS FOR SHERBORO INLET have been given as follow: From off the west end of the Bananas steer toward the Bengal Rocks S.S.E. $\frac{3}{4}$ E. [*S.E.* $\frac{1}{2}$ *E.*] 14 miles, and so as to give them a berth of about a league: having rounded these rocks, steer S.E. $\frac{3}{4}$ S. [*S.E. by E.*] 5 leagues, taking care to avoid the hard sand-bank on the east, which is steep-to. In running on, you may shoalen your water to 4 fathoms, on the flat of Yallucka River, upon the eastern side, and thence continue the same course, 4 leagues farther, to the southern bank, making due allowance for tide, whether ebb or flood. The last course will lead to a mile and a half from shore, in about 4 fathoms of water, and without the edge of the bank. You may now run up along shore, for two leagues, to *Jenkins*, taking care to avoid the edge of the Middle Ground on the north, which here leaves a channel of only half a mile between it and the shore.

BANK and SHOALS of ST. ANNE, &c.—The BANK of ST. ANNE, which has not yet been thoroughly surveyed nor defined, may probably extend from the parallel of 8° to $7^{\circ} 31\frac{1}{2}'$ N. and from longitude $13^{\circ} 6'$ to $13^{\circ} 32'$. The northern limit, as shown in the Table, page 29, is $7^{\circ} 56'$: this is the limit to which the bank has been *actually surveyed*; so likewise the western limit is given in $13^{\circ} 29'$, where there are 10 and 12 fathoms of water; but 13 fathoms have been found at 7 leagues more to the westward, upon the general

general bank of soundings extending from shore; and there is a spot of 8 and 9 fathoms in about $7^{\circ} 56' N.$ and $13^{\circ} 48' W.$ *

Upon the Bank of St. Anne are a number of small and dangerous insulated shoals, separated by channels of 6, 7, 8, and 10, fathoms. The bank itself is divided from that of the Turtle Isles by a narrow swashway, having 5, 6, and 7, fathoms.

But it appears that a vessel, bound from Sierra Leon to the Windward Coast, will clear every danger by proceeding over the great bank S.W. $\frac{3}{4} W.$ [*S.W. by S.*] 12 leagues, to the parallel of $8^{\circ} N.$; and thence, on the meridian of $13^{\circ} 40'$ to latitude $7^{\circ} 30'$, from which point a course S.E. by E. $\frac{1}{2} E.$ [*E. $\frac{3}{4} S.$*] 22 leagues, leads to the *Shebar* or Bar of Sherboro River, at the S.E. extremity of Sherboro Island.

When *Lieut. Badgley*, with other officers, and two boats, in 1826, proceeded from Great Turtle Island in order to survey the southern part of Sherboro Inlet, they found a good channel, with about 6 fathoms, but the atmosphere was so thick that the object was totally defeated. The colonial squadron was then at anchor at the *Shebar*, where was formerly the establishment of the infamous *James Tucker*; but which, the country having been ceded to the English, by the old king of Sherboro, had been deserted, and he had removed to the River Kittam, about 36 miles from the sea. From the old establishment the French and Spaniards had been in the habit of shipping annually about 20,000 slaves, collected from the three great rivers, *Bagroo*, *Dcong* or *Jong*, and *Kittam*; but as, by the cession of this territory, the British authority extended from Sierra Leon to the *River Galinhas*, the slave-trade was rooted out from the Sherboro, the most extensive mart upon the Grain Coast.

The *Boom Kittam River* runs in a parallel direction with the shore, at a distance from it of one or two miles. The strip of land between, called *General Turner's Peninsula*, is eight leagues in length, and it is terminated by the Forks, in longitude $12^{\circ} 8\frac{1}{2}' W.$ (See Table, page 30.) At $6\frac{1}{2}$ leagues farther to the S.E. is the *River Galinhas*, above-mentioned, the boundary of the colony of Sierra Leon. The river is navigable for boats only, and its entrance often becomes dangerous, by the breaking of the sea.

ADDITIONAL REMARKS on the COAST of GUINEA, &c.

(All courses and bearings by compass.)

A DESCRIPTION of the COAST, from the *River Galinhas* eastward, with directions for the same, is given in our "Sailing Directory for the Ethiopic or Southern Atlantic Ocean," which includes, particularly, "Descriptive Remarks and Directions by Captain TIROS. MIDGLEY." To the same gentleman we have since been indebted for the following observations on the vicinity of *Cape Palmas*, *Cape Coast*, *Bonny*, the *Camaroens*, &c.; and we embrace the present opportunity of giving them to the public in preference to withholding them for another edition of the volume above-mentioned, the time of a reprint being uncertain. In his communication, dated 26th June, 1838, Captain M. says, "The experience of my last voyage to Africa, (in the *Challenger*,) has tended to confirm what I have previously written with respect to the coast and the currents in its vicinity;" and he then adds as follow :†—

CAPE PALMAS, &c.—The coast in the neighbourhood of Cape Palmas is exceedingly dangerous. Should a vessel be to the westward of *Coley's Rock* and the *Cape Shoal*, in the event of light winds or a sudden calm, it will be prudent to anchor, rather than run the risk of the current alone setting the vessel round the cape. I think that the position of *Coley's Rock* is not yet correctly known, and the most adviseable and certain way to keep clear of it is not to stand into less than 38 fathoms water at night, and to be careful not to raise the sand on the beach from the vessel's deck in the day. I have been assured, by an intelligent tradesman of *Grand Sestros*, who has been with me three voyages to England, and is well acquainted with this part of the coast, that the beach can just be seen from a vessel's deck when sailing near to the rock. The lead is the only sure guide for avoiding this dangerous rock in the night, (being careful not to advance into less than 36 or 38 fathoms of water) as the current is here very rapid, and there is a strong indraught toward *Cavally*,

* Journal of the Tartar, by the late Mr. Finlaison.

† Indications of a dangerous shoal, seen by Captain Midgley in about $44^{\circ} 10' N.$ and $22^{\circ} 58' W.$ are noticed in the Description of Shoals, &c. Section IV. hereafter.

between which place and *Tahou* the ground in-shore is very foul. Near Cape Palmas it will be very dangerous to lie-to, unless constant attention be paid to the lead.

CAPE COAST.—The late directions for Cape Coast Roads by Governor Maclean are judicious, but the light is very poor. The weather must be very clear when it can be seen 10 miles off, unless it has been much improved. I found a good and very convenient berth in 7 fathoms of water, with the lighthouse on with the highest part of the large black rock under the castle, distant off shore 2 miles.*

QUITTA.—Plenty of stock, &c. can be obtained at Quitta, a few miles northward of Cape St. Paul, where there is good anchorage in $5\frac{1}{2}$ fathoms, fine sand, with the Fort bearing W. by N. two miles.

WHYDAH.—On my passage thence to the Whydah I kept a good look out for "*Mount Palaver*" and the "*Two Brothers*," but for many miles to the westward of Whydah could make out no particular marks to distinguish the coast. Whydah is, however, easily found, as there are always vessels lying in the roads; but, should this not be the case, keep the beach in sight from the deck, when several low houses or sheds, with a high flagstaff, will be seen close down upon the beach, and with a good telescope, the town will be seen from the deck, about 3 miles inland. Anchor in any depth you choose with the flagstaff N. by E. or North, as the ground is all clear and good. No ship's boat can land here.

BONNY.—It may be dangerous to take Bonny Bar in light winds or thick weather, or unless the Peter Fortis and Jew-jew Points can be distinctly seen, as this is the only mark to keep clear of the west end of the *Baleur Sand*. The ebb tide out of New Calabar has a tendency to check a vessel over toward the Baleur, and the flood tide *vice versa*, or toward the Western Breakers. Care must be taken not to bring Jew-jew Point Northward of N.E. until the vessel is fairly over the bar, which may be known by the water deepening to 6 fathoms, when the vessel will be half or three quarters of a mile to the northward of the Baleur, and the Portuguese Channel will be fairly open. The flood tide through the latter sets to the W.N.W. and over the Western Breakers.

As the West end of the Baleur does not break, it is the more dangerous; for, when Peter Fortis Point is exactly on with Jew-jew Point, there are barely 2 fathoms at low water, and at two cables' length farther East the bank ripples. No vessel should attempt the Bar without a free wind or commanding breeze. The directions say that there are $3\frac{1}{2}$ fathoms at low water on the Bar, but I could never find more than a bare 3 fathoms, and think it will always be imprudent to attempt the Bar with a vessel drawing 16 feet before half flood, on account of the short heavy sea that runs over it during 8 months of the year. The pilots know the channel well, but cannot be trusted with the management of the vessel.

The leading mark for Bonny Bar still remains as formerly:—Peter Fortis Point a small sail's breadth open for the outer bar, and about the length of a walking stick for the inner bar; that is, open of Jew-jew Point.

It is at all times dangerous for a stranger to approach any part of the coast between the Rio Sombrero and Andony into less than 7 fathoms water, unless prepared to anchor; and when in the vicinity of Bonny River, constant and careful attention to the lead will be found essentially requisite.

* **CAPE COAST CASTLE.**—A notice dated *Hydrographic Office*, Admiralty, 1st Nov. 1839, states that, at Cape Coast Castle, all vessels in the Roads may ascertain the errors and rates of their chronometers, without exposing them to the risk of being carried on shore through the surf.

A flagstaff, with a gaff, has been erected on the southern turret of the castle; and, at 11h. 30m. mean time, on every day, a red flag, with a white ball in the centre, will be hoisted at the head, as a preparatory signal.

At 11h. 55m. Greenwich time, a black ball, five feet in diameter, will be hoisted at the gaff end, and the flag lowered; and, at the instant of noon, Greenwich mean time, the ball will be dropped from the end of the gaff, and will immediately disappear.

As the falling of the ball must occupy more than a second of time, the instant of noon is to be reckoned from the separation of the ball from the gaff.

The latitude of the flagstaff, as given in the notice, by GEO. MACLEAN, Esq., *President of Council*, is $5^{\circ} 5' 25''$ N. and its longitude $1^{\circ} 12' 5''$. Captain Vidal gives the flagstaff on the west bastion of the castle in long. $1^{\circ} 13' 51''$ W. Captain W. F. Owen had previously given it in $1^{\circ} 13'$, and our Table, page 30, which gives the longitude according to Captain Purchas, should be corrected accordingly.

Your friend (H. B. R.) is a little mistaken in his account of Bonny. Palm oil is *not* cheap, and no ivory whatever can be obtained in this river. The *Guana* is the *Jew-jew* or *Fatiche* of Bonny, and the *Shark* of *New Calabar*. The latter is esteemed a delicacy by the natives of Bonny, and whenever it can be caught is greedily devoured. The annual sacrifice of a female child was changed to triennial, but I am happy to add has been abolished more than nine years; and, thanks to the 'march of intellect' and European intercourse, is not likely to be again revived.

CAMAROENS.—The direction hitherto given for the Camaroens River, not being much calculated to assist a stranger, I send you the following, which were *partly* written by Capt. John Lilley of this town, (Liverpool) with some corrections of my own. Capt. Lilley's long experience and knowledge of the Camaroens River (having resided there some years,) will I think entitle his directions to much confidence. I distinguish Capt. Lilley's directions by inverted commas.

"From a berth of one league off the N.E. end of Fernando Po, if there be no current, steer E.S.E. $\frac{1}{2}$ E. by compass, keeping Bimbia Point a little on the larboard bow, until the low and level land that extends from it to the S.E. is distinctly seen from the deck. When two-thirds of the distance across, which will be in about 8 or 9 fathoms of water, keep the lead going, and do not approach this low land nearer than in $5\frac{1}{2}$ fathoms" (to avoid the Bimbia Flats) "until the S.E. extremity of it, which is the *False Cape Camaroens*, bears N.E. by E. by compass, when a vessel must steer directly for it. The False Cape is 11 or 12 miles to the S.E. from Bimbia, and is the first part of the land of the river that should appear to a vessel coming from the westward. The False Cape may be seen about 4 leagues off in clear weather, and in steering toward it, upon a N.E. by E. bearing, there should never be less than $4\frac{1}{2}$ and 5 fathoms of water, over a soft bottom, until nearly approaching the Cape. When the vessel is about half a league from False Cape, steer along the land into the mouth of the river, in about 5 fathoms of water, taking care not to go into less than $4\frac{1}{2}$ nor to more than 8 fathoms, until Cape Camaroens, which forms the Western point of Bimbia Creek, is abeam of the vessel, (bearing about W. by N.) whence steer toward Malimba Point, on about an E. by S. course, until *Greenpatch Point* (on the East side of Bimbia Creek) bears North, when you may safely anchor upon a muddy bottom, in 5 fathoms water, and send up a boat to Camaroens town for a pilot.

Greenpatch is a round point, sloping gradually toward the water's edge at high water, and has low smooth verdant bushes upon it, from which the point derives its name.

On sailing from the False Cape to the *Greenpatch*, should the lead give less than $4\frac{1}{2}$ fathoms, haul well to the Southward immediately, as there are several hard and shallow banks on the North side, which must be carefully avoided. (The North end of Fernando Po, kept well open of the False Cape, may be a good mark for avoiding them, but this mark I merely mention as an object for future investigation.) By keeping in the above depth of water, that is in from 5 to 8 fathoms, a vessel will be out of all danger from the *Dog's Head Reefs*, which extend nearly two-thirds of the distance across the mouth of the river, from Point Suellaba, and are always seen and heard at a great distance. The Dog's Heads are steep, having 14 fathoms very close to, and 10 fathoms within, at the distance of half a mile from them. On standing toward them, from the Northward, the depth increases very rapidly from 9 fathoms; and they are extremely dangerous, as the ebb tide out of the Camaroens, Malimba, and Qua Qua Rivers, and also out of Bimbia and Mordecai Creeks, which are branches of Bimbia River, combine together, and the stream rushes directly over them, with great velocity, at spring tides.

As the bottom of the channel into the Camaroen River is all soft mud, should hard bottom be found, the vessel will be out of the fairway, and the depths from sea up to *Greenpatch* should never be less than $4\frac{1}{2}$ nor more than 8 fathoms, to insure the safety of the vessel from the Dog's Heads; and there should not be more than 6 fathoms until the true Cape Camaroen bears N.N.E. or N. by E. The False Cape must not be brought to the Northward of N.E. by E. until the vessel is about half a league from it, as before stated, and with light winds frequent bearings should be taken, should the tides of flood or ebb have effect upon the vessel.

It may not be superfluous to remark that too much attention cannot be paid to the lead and lines, when in or near this river, as the water shoalens and deepens in some places very suddenly, particularly between Cape Camaroen and the Dog's Heads, or about S. by W. from that Cape.

In case a vessel is obliged to anchor off Cape Camaroen, she will find much less tide and easier riding in 5 or 6 fathoms than she would in deeper water.

An instance having occurred of a vessel's boat going up the *Malimba River* (where there is no trade) instead of the Camaroen, it may be advisable, in sending from Greenpatch for a pilot, that the boat should keep the North shore aboard until she gets six or seven miles above Mordecai Creek (which is the second creek or bight on the North side of the river, and of which Greenpatch forms the Western point,) then haul over to the South side of the river, and the vessels will be seen, if there are any in the river, at King Bill's Town, about 3 miles above Doctor's Creek, on the South side of the river, and about 15 or 16 miles above Greenpatch.

From the anchorage at Greenpatch the Camaroen River does not appear to run up the country, but rather looms like a bay, with low land and detached tall trees at the bottom of it, and a stranger may be easily deceived if he does not take the above precaution of keeping on the North side of the river.

At Greenpatch the tide flows at 5 h. 30 m. full and change, and rises above 8 feet. The water at Camaroen town is fresh and fit for use if filled from between half ebb and low water.

Dysentery and intermittent fever are very prevalent diseases in this river, but their severity may be much alleviated by keeping the vessel as dry as possible. The worst effects have resulted from the unnecessary and very pernicious practice of washing decks at night in this as well as other African rivers. In all the rivers of Africa, but particularly in the Camaroen, ships should have a considerable stock of *quinine*.

Vessels intended for Camaroen should be well provided with good ground tackling, and be well manned and armed, for the tides are uncommonly strong, and the natives are of a very warlike and turbulent disposition, and universally dishonest in all their dealings. Their kings or chiefs have no power over them; and in chicanery, low cunning, and treachery, they far surpass any other people on the coast of Africa.

FERNANDO PO.—The ISLAND of FERNANDO Po has not yet been fully described. The advantages of this fine island have been shamefully overlooked, and I may say criminally neglected.—(*Capt. M.* 4th Nov. 1839.)

The same reasons for including the preceding Remarks on the Coast of Guinea, &c. induce us to add the following on the Island of Ascension and the Cape of Good Hope.

ISLAND OF ASCENSION.

In the Directory for the Ethiopic or Southern Atlantic Ocean, we have described the condition of, and given directions for proceeding to, the island of Ascension. The following additional instructions have been extracted from a letter written by Rear Admiral the Hon. G. Elliot, commander in chief on the Cape of Good Hope station, 11th February, 1840.

“The most simple directions for anchoring at Ascension seem to be to round the North side, keeping at not less than three quarters of a mile from the land till the Fort is nearly open; then haul close along shore, which is quite steep, and may be approached to a cable's length. In this way a ship will always fetch a good anchorage, without a tack; and it is not advisable to stand over near the Western rocky bank, in the variable winds under the land, with a view of tacking into the anchorage. Fresh water now can always be had at Ascension.”

The Dutch ship *Scheld* struck on the shoal above alluded to, in November, 1839, and went down with all sails set; but happily the crew were saved, and relieved by H.M.S. *Melville*, and afterward sent to the Cape.

It was previously stated, by a correspondent of the Nautical Magazine, 1836, that, at the agricultural station on the mountain, much had been effected by the small detachment which could be spared from other works. There the decomposition of volcanic matter is going on rapidly, and consequently producing a rich and productive soil, a large portion of which is cultivated with trees, shrubs, edible and other plants. In this soil mosses, grasses, heaths,

heaths, and flowers, have also been carefully and successfully planted. The botany of Ascension boasts of 170 varieties. Among the more essential vegetables may be found balm, thyme, horehound, borage, potatoes, beet, parsnips, carrots, turnips, lettuce, endive, celery, mustard, parsley, fennel, radishes, sorrel, winter cherry or Cape gooseberry, arrow-root, horse radish, water cress, French beans, leeks, onions, shallots, artichokes, capsicums, cucumbers, pumpkins, tomatoes, mushrooms, cabbages, &c. All these are more or less abundant as the season proves propitious to their culture; and it is fortunate that large tracts have been devoted to the cultivation of the sweet potato, which yields so plentifully that it may always be procured. Several other edible plants are equally to be depended on; and the garrison and shipping have, for some years, been readily provided with refreshment of this nature.—*Naut. Mag. Dec. 1837, 794—797.*

TABLE BAY, CAPE OF GOOD HOPE.

Since the publication of the Directory above mentioned, a time-ball apparatus has been established here, and commanders bound to this place will be pleased to know that it is erected before the front of the Observatory, for the purpose of daily communicating to the ships in the roadstead the instant of one o'clock, *Cape mean time*, which corresponds to 11h. 46m. 5s. of Greenwich mean time.

In order to obtain this important object, all that the observer has to do is to point the common ship spy-glass to the signal ball a minute or two before one o'clock, and to note the instant of the fall of the ball from the top of the staff, by chronometer. Then 11h. 46m. 5s. subtracted from the time by chronometer, gives the error of the chronometer, or *Greenwich mean time*, which, compared with the error obtained at departure, will give the rate during the interval.*

3.—THE AZORES, OR WESTERN ISLANDS.

The AZORES, OR WESTERN ISLANDS, are nine in number, and named Santa Maria, or St. Mary's, St. Miguel, or St. Michael's, Terceira, or Tercera, St. Jorge, or St. George's, Graciosa, Fayal, Pico, Flores, and Corvo. The land is, in general, high; the coasts steep and rocky.

These islands are said to have been discovered, about the middle of the fifteenth century, by Joshua Vanderberg, of Bruges, in Flanders, who, in a voyage to Lisbon, was driven to them by stress of weather. At Lisbon he boasted of his discovery; on which the Portuguese, in that spirit of enterprise so strongly manifested by them at this period, set sail and took possession of them, calling them *Azores*, or *Isles of Hawks*, from the many hawks and falcons found amongst them. It appears that they were entirely destitute of inhabitants, and of every animal excepting birds. The latter were numerous, and of various species.

Antonio Gonzalo says, that the great Don Henry, Prince of Portugal, considered these isles as so considerable an acquisition, that he went in person to take possession, in 1449. This was forty-three years before Colombo landed in America. And, it has been affirmed that, the Flemish merchants, on the part of their countrymen, sent a colony thither, many of whose descendants continue in Fayal to this day. Hence the isles have been also called *Flamingos*, or *Flemish Islands*.

The capital of the Azores is *Angra*, in Terceira, the residence of the civil governor; but the general residence of the bishop is in the island of St. Michael.

The inhabitants, generally, have been described as an innocent, good, and honest people, who prefer the olive to the laurel, and who would seek for distinction rather by industry than by arms. The climate is delightful; the air generally clear and serene; the soil so prolific, that both European and tropical plants arrive at the greatest perfection: the face of the earth is, however, so diversified, as in some places to exhibit, within a small extent, volcanic hills and productions, gardens of aromatic plants, pastures, vineyards, orangeries, &c. The greatest inconvenience of these isles is, their having been subject to eruptions

* This, it may be observed, is upon the principle of the apparatus on the Royal Observatory at Greenwich.—EDIT.

and earthquakes; and, in some parts, where the coasts are low, the sea has, at times, overflowed the land, and occasioned considerable mischief. Yet, in the cultivated parts, the lava, once a stream of fire, is planted with oranges, lemons, and vines; and the land, formed from the decomposition of volcanic substances, is sown with Indian corn, small beans, and wheat. The islands still abound in waste lands, fit for the cultivation of hemp, the vine, &c.

Being generally mountainous, they may be descried from a considerable distance; particularly the peak on the Isle of Pico, noticed hereafter, which may be seen more than 20 leagues off.

In the winter season, storms, with much wind and sea, dark and rainy weather, from North to West and South, are frequent.

ST. MICHAEL'S.—The Island of St. Michael appears to have been originally a plain, covered with beautiful trees, rich verdure, and aromatic plants; at the present time, however, it consists of a number of mountains, hills, and declivities, none of which are primitive, but evidently the production of volcanic eruptions. The mountains and hills clearly indicate, by their conical figure and the cavity at their summits, their being the production of fire, and bear unequivocal marks of the effects of this destructive agent, in an accumulation of lava, scorix, and volcanic sand.

Externally, the volcanoes appear extinguished, but they are supposed still to burn internally and invisibly. Of this, *Caldeiras*, or fountains of boiling water, in the Valley of Furnas and other parts, are evident symptoms. Circumstances, also, afford strong reasons for believing that there have existed three principal craters, whose vertex now form three great lakes, situate toward the centre and the northern and southern portions of the islands. From those craters vast mountains have been thrown up; and, in proportion as these ceased to vomit forth matter, partial eruptions burst out, and formed the lateral hills and declivities, which extend themselves in every direction from the mountains surrounding the lakes. The cessation of fire from the different craters has been attributed to water, which appears to have gained access to each, and suddenly extinguished the effervescence of its mineral contents: and the fire now seems confined to stations, where it operates only in boiling the water, with various degrees of activity and force.

Exclusive of the remains of burning volcanoes, the island presents decisive evidence of its having been the theatre of repeated earthquakes and convulsive shocks. In most countries, earthquakes are produced by sulphur and nitre, or by sulphur sublimed from pyrites, and ignited, in subterraneous caverns, by a fermentation of vapours, which gives an appulse to the neighbouring combustible matter, and causes it to be discharged with a noise like thunder, and sometimes with an eruption of water and wind: but here the earthquakes seem to have been occasioned by a contrary cause; by the bursting in of the waters upon the mineral fires; an agency which must have instantly produced sudden blasts, violent explosions, rumbling in the bowels of the earth, and that lifting up of the ground above it, which occasions havoc and devastation till it gets vent or discharge. That this is the case, appears incontrovertible; for many of the existing extinguished volcanoes, which served as so many spiracles for the discharge of subterraneous fire, are rent and torn asunder by the violent effervescence caused by the sudden conjunction of the two opposing elements.

The effect produced by this unnatural confluence of fire and water, is not confined to fissures in the craters, and rents in the cliffs; some mountains have been precipitated into the adjacent valleys, others upset from their base, and some swallowed up in the bosom of that earth, whence they originally rose in lava, scorix, and sand. The bases of the precipitated mountains, exhibit palpable remains of decomposed substances originally produced on the surface of the globe; the strata of the mountains nearly upset, is displayed perpendicularly, and not horizontally; and those mountains which have been swallowed up, have left behind them some frightful chasms, tremendous precipices, or form the beds of beautiful lakes. The more perfect mountains are of a conical or hemispherical figure, as formed by continued eruptions, and their exterior is distinguished by characters which denote the nature, and, in some measure, the date, of the conflagration. The lava, on some, appears in craggy eminences; and, on others, is in a state of decomposition, forming a soil highly fertile and productive. The various features of the ground show where the lava ran without interruption, only filling up inequalities in a lovely champaign country; and where its course was impeded so as to leave insulated spots or oases, covered with all the bloom of luxuriant vegetation, while encompassed by mountainous ridges of volcanic ashes, with ferruginous and pumice stone.

The island, at length, seems to be of such a structure and conformation, that the waters pass freely throughout its volcanic caverns, and are easily forced out without shaking or disturbing the earth. One hundred years have elapsed since the inhabitants have been terrified by volcanic explosions of a terrific nature;* and what is now heard, and that perpetually in several places, resembles the flowing and ebullition of waters, with a dull noise, like that of a heavy carriage rolling along in rapid motion: and, it seems that, in consequence of the introduction of the waters into the subterraneous caverns, and of the washing away of the sulphur and nitre from their arches, the fire has ceased to appear in frequent eruptions as formerly, yet it operates invisibly on the waters contained in the caverns beneath.

These observations, which were previously written, have been corroborated by a remarkable event. In the early part of the year 1811, a most awful and tremendous explosion of smoke and flames having issued from the sea, at the distance of half a league from the shore, at the western end of the island. From the depth of about 40 fathoms, in the ocean, issued smoke, fire, cinders, ashes, and stones of an immense size. Innumerable quantities of fish, some nearly roasted, and others as if broiled, floated on the surface of the sea toward the shore. Thus a dangerous shoal gradually formed.† On the 10th of June, the crew of the *Sabrina*, British sloop of war, observed two columns of white smoke arising from the sea, which they supposed to arise from an engagement, and made sail toward it, but were disappointed by the wind's dying away. The smoke continued to ascend, with volumes of flame, and they then concluded it was a volcano. Next day they were close in with the land of St. Michael's, and found the volcano still raging. They learned, on the island, that smoke was first observed on the 13th of June; two or three days previous to which, there had been felt repeated shocks of earthquake in the capital of St. Michael, which threw down several cottages and portions of the cliff toward the N.W., so that destruction was feared on the island; but these ceased so soon as the volcano broke out. On the 18th the *Sabrina* went so near to the volcano as she could with safety, and found it still raging with unabated violence, throwing up, from under the water, large stones, cinders, ashes, &c., accompanied with several severe concussions. About noon, on the same day, they observed the mouth of the crater just showing itself above the surface of the sea, where there were formerly 40 fathoms of water. At three *p. m.*, same day, it was about 30 feet above the surface of the water, and about a furlong in length. On the 19th, they were within 5 or 6 miles of the volcano, and found it about 50 feet in height, and two-thirds of a mile in length; still raging as before, and throwing up large quantities of stones, some of which fell a mile distant from the volcano. The smoke drew up several water-spouts, which, spreading in the air, fell in heavy rain, accompanied with vast quantities of fine black sand, that completely covered the *Sabrina's* decks, at the distance of 3 or 4 miles. On the 20th, they proceeded on a cruise, leaving the volcano about 150 feet high, and still raging, as formerly, and continuing to increase in size. On the 4th of July they again visited it, and found that a complete island was formed, and perfectly quiet. The captain and several officers landed upon it, and found it very steep, and its height from 200 to 300 feet. It was with difficulty they were able to reach the top, which they at last effected, in

* The approximation to an eruption has, however, at times appeared to have been very close. On the 11th of August, 1810, at the hour of 10 *p. m.*, slight shocks of an earthquake were felt, which continued, at intervals of a few minutes, for four hours. Between two and three o'clock next morning, a dreadful rocking was experienced throughout the whole island; several houses, unable to resist its violence, were thrown down, and many others were greatly damaged; and such persons as sought safety in the open air were dashed to the ground. On the eastern side of the island an orifice was discovered, resembling the crater of a volcano, and out of which flames occasionally burst forth; but they do not appear to have been accompanied by any ejection of volcanic matter.

The original account of this convulsion stated, that the village of Cozas was swallowed up, and that a lake of water remained in its place: but we have been informed, on the most respectable authority, that "no such village as Cozas ever existed in St. Michael's. The shocks felt in 1810 and 1811 did considerable mischief at the Mosteiros and parish of Ginetes, at the west end of St. Michael's, throwing down many houses, church-steeple, &c.; but no lives were lost."—(*St. Michael's*, 7th Oct. 1818.)

† The flames were first seen in the night of the 1st of February, but invisible indications of its operations had been felt in shocks on the island from the middle of the preceding year. Its observed situation was S.W. of Point Ferraria, and due West from the Pico de Ginetes, at about $1\frac{1}{4}$ mile from the nearest shore. The brig *Swift*, with all her crew, were lost on this spot, before the existence of the shoal was known.

a quarter where there was a gentle declivity; but the ground, or rather the ashes, composed of sulphureous matter, dross of iron, &c., was so very hot to their feet, that they were obliged to return. They, however, took possession of the islet, in the name of his Britannic Majesty, and left an English union-jack flying on it.

The form was nearly circular, and the circumference of the isle, at this time, about a mile. In the middle was a large basin of boiling water, whence a stream, of about six yards across, ran into the sea, on the side facing St. Michael's; and, at the distance of 50 yards from the island, the water, although 30 fathoms deep, was too hot to hold the hand in. In short, the whole isle appeared as a crater; the cliff on the outside as walls, steep within and without. The basin of boiling water being the mouth, from which the smoke, &c. issued.

On the 17th of June, Captain Tillard, of the *Sabrina*, accompanied by Mr. Reid, the British Consul, with two other gentlemen, proceeded overland to the cliff nearest to the volcano; and which was between 300 and 400 feet above the level of the sea. The first appearance it presented was that of an immense body of smoke revolving in the water almost horizontally, in varied involutions; when suddenly would shoot up a column of the blackest cinders, ashes, and stones, in form like a spire, and rising to windward at an angle of from 10 to 20 degrees from a perpendicular line. This was rapidly succeeded by a second, third, and fourth, each having greater velocity, and overtopping the preceding one, till they had attained an altitude as much above the level of the eye on the cliff, as the sea was below it. The columns of ashes, &c. at their greatest height, formed into branches resembling magnificent pines; and, as they fell, mixing with the festoons of white feathery smoke, at one time assumed the appearance of vast plumes of black and white ostrich-feathers; at another, that of light wavy branches of a weeping-willow. These bursts were accompanied by explosions of the most vivid lightning, with a noise like the continual firing of cannon and musquetry intermixed; and, as the cloud of smoke rolled off to leeward, it drew up the water-spouts, above-mentioned, which formed a beautiful and striking addition to the scene.

Subsequently, the islet fell, by degrees, into the sea; and, in the middle of October, no part was left above water; but a dangerous shoal remained in the place which it had occupied. In February, 1812, smoke was discovered still issuing out of the sea near the spot.*

ST. MICHAEL'S contains one city, five principal towns, fifty-four parishes, and about 80,000 inhabitants. The coast is very bold, and may be approached without fear in almost every part, the N.W. side excepted. Its military strength consists of 300 or 400 troops, with a militia of several thousand peasantry, whose arms are the pikes with which they drive their cattle. The principal fortification is the castle of St. Bras, which is close to the sea, at the western end of the city of Ponta del Gada. It is mounted with 24 pieces of cannon, but few of which are capable of service. A league to the eastward are two small three-gun forts, inefficient from decay and neglect. The island, notwithstanding, has many strong local holds; and several of the hills and passes, if judiciously fortified, would be impregnable.

The rich level country is properly adapted for wheat, Indian corn, and beans, or callivances. In the lava districts are cultivated the vine and orange, which yield most abundantly. It is generally understood, that the lava, in the S.E. region of the island, is older, softer, and becomes fertile sooner, than that of the N.W., which retains such a degree of hardness as to be, in many parts, altogether incapable of yielding to human industry. In the intermediate parts, between the volcanic lands and the level country, the surface exhibits volcanic sand, metallic slag, pumice-stone, &c.

The inhabitants of this and the other islands were formerly compelled, by law, to confine their trade to the port of Lisbon; but latterly they have been allowed a wider range, and

* About 15 leagues to the westward, a volcano, which had appeared in 1638, broke out from the sea in 1719, and disappeared in 1723. A depth of 80 fathoms was afterward found on the spot which it had occupied.

A beautiful print of the eruption of 1811 was subsequently published by Messrs. Boydell and Co. An earthquake may probably obliterate every indication of this phenomenon.

In Dr. Webster's late account of St. Michael's are some further particulars relative to the earthquakes, &c. in 1811, and it appears that the first appearance of a sub-marine volcano was, and left a shoal, to the westward of the spot in which the islet afterward appeared.

maintain a considerable commerce, not only with Lisbon, but with England, Russia, America, &c. From England they are entirely supplied with woollens, hardware, earthenware, and various other necessities, sending in exchange about seventy vessels annually with fruit. To Portugal are sent corn, pulse, poultry, cattle, and vegetables, which are paid for in returns of tobacco, sugar, coffee, trinkets, dispensations, indulgences, images of saints, reliques, &c. From America, they receive boards, staves, lumber, rice, fish, pitch, tar, iron, in pots and bars, and a variety of Indian goods, which are paid for, in exchange, by wines. The intercourse with Russia is similar to that with America, but on a more contracted scale. There exists, also, a ready-money trade with vessels which make the island for refreshment, the crews of which are furnished with cattle and provisions equal to the English, and to any in the world beside; and, also, with wine, pleasant, and peculiarly suited to the health of seamen.

The CITY OF PONTA DEL GADA is the chief seat of commerce. This town appears exceedingly pleasant from the offing, and derives an air of dignity from its numerous convents, &c. There is a mole for the protection of small vessels, but those of greater burthen are compelled to ride in an open roadstead.* By deepening and enlarging the harbour, it might be rendered capable of receiving vessels of a considerable draught; and, by excavating the square of St. Francis, and cutting a canal between it and the mole, a large number of vessels might be accommodated. As it is, vessels of burthen cannot safely use it; for they would risk the danger of slipping their cables, while loading or unloading, and perhaps, not be able to recover their station for several weeks; or, at least, not dare to attempt its recovery during the prevalence of strong southerly gales.

The roadstead and harbour of Ponta del Gada are, however, the best that the island affords. The place of next consequence is that called RIBEIRA GRANDE, on the north side of the island; but here is no anchorage; and, having no harbour, it is dependent for its commercial supplies on the towns on the south side. VILLA FRANCA, which is on the latter, has a very inferior anchorage, and that for small vessels only.

The disadvantages arising from the want of naval conveniences are greatly aggravated by the customs of the country and its government: but, with all these disadvantages, the country has improved, and exports annually about 15,000 tons of fruit, wine, and provisions, the amount of its surplus produce. Yet it has been stated to us, by a person well acquainted with the island, "that arts, agriculture, and commerce, are not carried to more than a twentieth part of the extent to which they might extend; nor is the population by any means proportioned to the extent of territory."

The COASTS OF ST. MICHAEL, being bold all round, may be approached without fear, as there are no rocks or dangers more than a furlong from the shore, excepting some rocks at the N.W. end, and the volcanic shoal, already described. The former extend about half a mile from the bay of Mosteiros, near the north-western point. The winds most prevalent, from October to April, are from S.W. to N.W., which frequently come in heavy squalls, particularly from the northward. In approaching from the eastward, Ponta da Galera, the southernmost point, should have a good offing, as the high land above it often occasions a calm, and there are some rocks off the point.

* See the particular plan of this roadstead on the Chart. The following notice was issued from the office of the British Consul-General, dated St. Michael's, 10th November, 1816.

"NOTICE is hereby given to navigators, that the following LIGHTHOUSES are now establishing on the South side of this island, viz. on the top of the cathedral-steeple of Ponto del Gada city, at an elevation of 110 feet above the surface of the water, a lighthouse is completed, and lighted up with eight glass-lamps and reflectors; at the east point of the bay, called Ponta de Galera, another lighthouse is begun, which bears S.E. by E. from the cathedral-lights, distant about nine nautic miles, will be completed about the 10th of December; and a third lighthouse, on a peak, situate at the S.W. quarter of the island, near Ponta de Ferreira, is expected to be ready by the 1st of January, 1817; and, in the event of the funds collected being sufficient, it is in contemplation to erect a fourth light at the N.E. point of the island.

"The following rates are established for the maintenance thereof: vessels under 50 tons burthen, half a dollar, or 500 reis; from 50 to 100 tons, one dollar, or 1000 reis; from 100 tons, upward, one dollar and a half, or 1500 reis.

"The said lights will be shown every night, throughout the year, from half an hour after sun-set to half an hour before sun-rise. (Signed) WM. HARDING READ, Consul-General."

October, 1818.—"There is now a very poor light on the cathedral-tower, and another in a lighthouse on Ponta de Galera. They are miserable; neither of them can be seen more than six or seven miles off: AND. LIVINGSTON."

On approaching the N.W. end of the island, from the westward, the appearance is very unpromising, as it presents barren mountains of stupendous bulk, with a coast like many ramified pillars of basalt, exhibiting, at top, a few trees of stunted growth. The impression made by a scene of rough and craggy cliffs is, however, soon dissipated by a pleasing contrast on the southern coast, as this presents a beautiful acclivity, adorned by luxuriant vegetation. Open pastures, bounded by woods, vineyards, and corn-fields, interspersed with orange and lemon trees, every where meet the eye, and afford a landscape, extensive and various, that will always, in clear weather, be seen with delight.*

The ROAD of PONTA DEL GADA, of which a particular plan is given on the Chart, has good holding-ground, on which ships may ride safely, excepting during gales from W.N.W. to S.S.E. The best marks are those shown on the Chart. Should a vessel be forced to quit the anchorage in winter, by a southerly gale, it will be best to round the western end of the island, and await a shift of wind from the N.W., which commonly succeeds a S.W. wind. Thus may the roadstead be easily regained; but, by running to the south-eastward, it may be ten days, or more, before you can beat back to the road. In beating up, keep close in shore, only avoiding some rocks which lie near Ponta da Galera. The tide sets here, as shown in the Table, page 149. Fresh water is easily procured in the craft of the island.



Outline of the land over Ponta del Gada.

Those coming in, on the northern side of the island, must be cautious of not getting embayed near Ribeira Grande, as there is no good anchorage on that side in case of a shift of wind.

The ROAD of VILLA FRANCA is sheltered by the *Porto do Ilheo*, a remarkable volcanic rock, having a circular basin in its centre, with an entrance to it on the N.E., fronting the town of Villa Franca. The entrance of this basin has 7 feet of water, and is just broad enough to admit a small vessel. The basin is about 100 fathoms in breadth, and has had a depth of from 8 to 18 feet; the bottom of sand and small stones. This place is resorted to by small vessels for the purpose of careening, &c. It affords shelter from gales between West, and South; but, as a part of the S.E. side is low, the wind, from that direction, throws a heavy swell into it, and renders it dangerous: and vessels, caught with this wind, must be scuttled, as the only way to save them. Not more than four vessels can lie with safety on the outside, in winter, under shelter of the rock on the N.E., where there are 4 and 5 fathoms of water. The ground near the town, is foul and dangerous; but, it is stated that, a ship may lie in 8 or 9 fathoms, between the town and islet, by fastening a hawser on shore.

The *Porto do Ilheo* is a great natural curiosity; it having been originally a volcano of great height, whose apex has fallen into the caverns beneath, and forms the basin. Its

* The finely cultivated lands, which will be seen in the vicinage of Ponta del Gada, once exhibited a rugged superficies of lava, and still consist, internally, of alternate layers of lava and vegetable earth. The lava, on the surface, resembles slate-coloured rock; in some places as hard as marble, in others of the consistence of indurated sand. All the principal improvements here have been made upon these obdurate substances.

appearance is extremely rugged and irregular. On its south side is a remarkable detached rock, distinguished by the name of the *Pyramid*.*

The breakers seen to the N.E. of St. Michael's will be found described in the next section.

Don Vincente Tofino, in his description of St. Michael's, states that, *POINT FERRARIA*, the westernmost point of the island, is high and sloped, but a low point projects from it into the sea, so as to form a rocky ridge to the S.W. At the distance of a league from land, this ridge has over it from 7 to 10 fathoms of water, and a heavy sea rises over it, very high.† The little harbour of *Mosteiros*, to the N.E., serves for boats only. Of the islets here, the largest is high, sloped, and smooth, at its summit, with an aperture through which the sea passes from one side to the other.

NORTH SIDE OF THE ISLAND.—Between the *Ponta (Point) dos Mosteiros* and *Ponta da Bretanha*, the land of the coast is high and rocky, and it forms the bay of *Joam Bom*; at the bottom of which appears a very sharp-pointed mountain, called the *Pico de Maffa*, which serves as a very useful mark for ascertaining the coast.

Within the *Ponta da Bretanha*, and extending eastward, is the long village of *Bretanha*. The country here is highly cultivated, and pasture land.

The *Villa da Ribeira Grande*, already noticed, is rich, stored with all kinds of provisions, and abounds with good water; but landing is practicable only when the sea is very smooth.

The N.E. *POINT* of the island is *Ponta da Reveira*; at more than three miles to the S. by W. [*S. by E.*] from this is the *Ponta del Arnel*, having a small port of the same name, but it is unsheltered, and the bottom rocky. The two points are of equal height, but between them is a slender bay, with sloped rocky land, in the middle of which is a very remarkable glen, wherein is a small river.

Of *VILLA FRANCA*, Tofino says, "It is situated on a beach, which forms but a very small bight. The channel between the islet (*Ilheo*) and coast, is of the width of three cables' length, or thereabout, and is its principal anchorage; it has 10 and 11 fathoms of water, sandy bottom, and vessels moor North and South, with a hawser on shore, on the islet; but the latter, owing to its diminutive size, does not shelter a vessel from the wind and sea between E.S.E. by South, to S.S.W. The town is capacious, and water, with all kinds of provisions, may be had here.

ISLE OF ST. MARY.—The preceding description of the appearances of St. Michael, will apply generally to St. Mary's, and the other islands. The town is on the south side, toward the west, on a bay, in which there is an islet; and between this island and the land is the anchorage, with a depth of 6 and 5 fathoms. For the position of the town and the chief points of the isle, see the Table, page 34.‡

ST. MARY'S has a town and three villages, with about 4500 inhabitants. Its chief productions are wheat and barley, of the first quality, with wine and cattle; but only sufficient for its own consumption. It has water in abundance, but of wood little, and a scanty proportion of fruit and vegetables.

The eastern side of this island is high and broken, and the western low and even: on the first are several mountains and peaks, of which the most elevated is called the *Pico Alto* (High Peak.) The coasts are clear and very bold, and may be approached with safety.

* In a letter to the Editor, dated 28th May, 1828, Captain Livingston says, "The *Ilheo* seems to be filling up with sand. The most of the rock is a kind of conglomerate of lava, in detached pieces, sand, debris, and pumice-stone, and on the east side it seems gradually wearing away. The highest part appears to be about 80 feet high. There are cultivated terraces on it, with cane-reeds, planted for shelter, and they grow not only potatoes and maize on it, but there are even a few poor vines, and some fine heath, 3 to 4 feet in height.

† The singular volcanic *Peak of Camarinhas*, on the west end of the island, was the last active volcano in St. Michael's."

‡ There is a similar ridge, with islets on it, extending about a league from Point Matogos, the N.W. point of the island: it has from 2 to 6 and 7 fathoms over it.

§ Immense quantities of molluscæ, or sea-worms, are certain signs of the proximity of St. Mary's. Some of them are of a white colour, or of arrow-root mixed with hot water, and are about 18 inches long, with orange spots on them, like the eyes of a peacock's tail.—A. Livingston.

PONTA DE CASTELO, the S.E. point, is high, and has a break, which forms a peak, in the shape of a sentry-box. A vessel may anchor with this point S.W. by S. [*S. by W.*] and close to it in 10 fathoms, bottom of sand.

On the EASTERN COAST, at $2\frac{1}{2}$ miles N.N.E. [*N. 2° W.*] from Pta. de Castelo, is the *Ponta dos Cedros*, which is likewise high: between these is a small point, off which is a low rock, at 3 or 4 cables' length from the coast, called *Baja da Malla*, but between it and the coast is a clear passage of 12 fathoms, in mid-channel, at half-flood.

At N. by W. [*N. W. by N.*] $4\frac{2}{3}$ miles from Pta. dos Cedros, is *Ponta dos Matos*: between is the *Pta. de la Feitera*, with the islet and port of *San Lorenzo*. The point is high and remarkable, when near the coast: the islet is likewise high, and, on the eastern side of it, has a cave, into which the sea enters, and where a boat may be sheltered.

The port of SAN LORENZO is formed by the islet and *Ponta dos Matos*, which are a full mile distant from each other. The bottom is sandy, and between the points is a depth of 10 fathoms, increasing gradually outward, but the depth of anchorage should not be less than 20 fathoms. Water may be readily obtained here, by making hollows, or small pits, in the sand on the beach, where the least excavation produces water of the best quality. There are several houses and a church close to the beach.

The PONTA DAS LAGOINAS is the N.E. point of the island. The islet Lagoinas, which lies off this point, is high, and sloped like a mitre; and, on being seen, in an east or west direction, exhibits a small level point, extending a little way into the sea. A rock, lying between the islet and land, obstructs the passage to large vessels.

The NORTH SIDE of the island affords neither shelter nor anchorage; the whole of the western side is low and uniform.

The PORT and TOWN are situated, as already noticed, on the S.W. side of the island. The bottom here is sandy, and in some parts rocky, with from 10 to 4 fathoms of water. The rocky part is on the western side, and the eastern is the clearest. The *Ponta da Marban* is the easternmost point of the bay, and this, with the next point to the eastward, *Malbusca*, form a larger bay, divided into two parts by a black point, *Pedreira*: The coast hither, from Point Marban, is the most regular, and is called *Figueral*; on the top of it is a remarkable rugged mountain, but it is not so high as those on the north side of the island. *Ponte de Malbusca* is high, and stands at the distance of 2 miles to the westward of *Ponta de Castelo*, the S.E. point of the island.

The ROAD OF ST. MARY is open, and exposed to southern gales. On this account it is resorted to, in summer, by small vessels only. In order to be ready for a start, it is proper to anchor to the S.E. of Marban Point, opposite *Figueral*, already described. The best anchorage, known to the pilots, is about a mile from the coast, in a line with *Malbusca* Point, and with the castle at the S.W. part of the town of St. Mary, entirely open of Marban Point. Here is a depth of 36 fathoms, bottom of sand; but, at a short distance eastward, the ground is foul. Hence it is, that Port San Lorenzo, on the N.E. side, is considered as the best anchorage about the island. At either place refreshments may be obtained, as at the other islands, with the addition of partridges, which abound here.

In the Road of St. Mary's the convoy from St. Helena took shelter, during a gale, in 1813. The following extract is from the journal of Captain Abr. Bristow, of the ship *Thames*, one of the fleet. It is descriptive, and may be useful.

“Nov. 23. Hard gales from the N.N.E., with harder squalls, attended with rain and a tremendous high sea. At one *p.m.*, rounded a small islet, (*Riveira Seca*, at the S.W. end of St. Mary's), and hauled up by the wind to gain an anchoring berth; and, in a few minutes, brought up, in 17 fathoms of water, dark coarse sand and gravel. Here our whole fleet found shelter from a most dreadful storm. Our commodore saluted the fort, and it, after a while, returned the compliment. From our site the small islet bore N.W., 2 miles; the town, N.E. by E., $2\frac{1}{2}$; nearest shore, $1\frac{1}{2}$; and the easternmost land in view, E.S.E., 6 or 7 miles.

“Nov. 24. Blowing very hard in the N.E., so that our boats can have no communication with the shore. Feel comfortable to be so well secured from the fury of the storm. Middle part of the day, the gale still furious, with violent squalls, attended with rain. At half-past eleven, *p.m.*, our cable was cut off by a rock, and we drove out to sea, but afterwards recovered our station. At one *p.m.*, on the 25th, having got well in with the island to the eastward of the roads, I hove about, and fetched into a good anchoring berth in 10 fathoms,

fathoms, with the town distant one mile.—The anchor was afterwards recovered ; but the best bower-cable was greatly injured by the foulness of the ground.”

The FORMIGAS, or ANTS, which lie to the north-eastward of St. Mary's, are a range of 7 or 8 high rocks, extending N.N.E. and S.S.W. [*N. and S.*] about three-quarters of a mile, and among which there are other rocks under water. The highest, which is nearly 60 feet in height, bears, from a distance, some resemblance to the sails of a ship, and lies two-thirds of the length of the range toward the North. At the north part are many rocks under water. Close along-side is a depth of 7 fathoms. The Formigas have a dreadful appearance, the breakers commonly flying higher than a ship's mast-head. At a time when the sea ran from the westward, no soundings could be found off the eastern side, with a line of 50 fathoms, until within 30 yards of the rocks. The position may be seen in the Table, page 34.

Between the Formigas and the Island of St. Mary, no bottom was found with a line of 120 fathoms, until within one quarter of a mile from the island.*

To the S.S.E. of the Formigas there is a danger, which was shown on a Chart of the Atlantic Ocean, 1766 ; but afterward omitted in other charts, from want of positive information as to its existence. This shoal was seen by *P. Dollabarats*, commander of the ship *la Marie de Seboure*, in 1788, on his return from Martinique to Bayonne. On the 7th of March, at three *p. m.*, when about to double the Formigas, at the distance of three-quarters of a league, he descried a breaker to the S.E. of his ship, which appeared to extend a league *true North and South*. He observed, that it lies S.E. 5° S. (true,) at the distance of $1\frac{1}{2}$ league from the Formigas.

The following is an abstract of the Description by Tofino. “The FORMIGAS are some rocks which navigators have considered as extremely dangerous, imagining a great part of the space hereabout to be strewed with sunken rocks, and therefore to be avoided ; but, having examined these dangers, it is proved that the whole of them are visible, concentrated, and clear, and that vessels of any burthen may steer for them, in order to pass on the north or south side, as may be most convenient.

“The trend of these rocks is N.N.E. $\frac{1}{2}$ E. [*N. 5° E.*] and S.S.W. $\frac{1}{2}$ W. [*S. 5° W.*] in an extent of about six cables' length. The larger islet is a heap of rocks, through which the water scarcely finds entrance. From this islet Pta. de Castelo, St. Mary's, bears S.W. $\frac{1}{4}$ W. [*S. $24\frac{1}{2}^{\circ}$ W.*] and the highest peak of that Island, S.W. by W. [*S. $34\frac{1}{2}^{\circ}$ W.*] To the N. 5° E. *true* of the islet is a large round rock, hollow on the south side, which may be from 10 to 12 yards high, and is the highest of the whole. When viewed from a distance, the Formigas appear like a city, the inequalities in height having the appearance of edifices. On the south side of the large Formigas, at about a cable and a half, is a shoal, partly above water : there are from 7 to 12 fathoms near it, and in the channel, which it forms, 20 fathoms.”

In this description, by Tofino, we have an instance of improperly blending one thing with another. The Formigas are properly described, but other rocks also exist, as shown in the next paragraph, at the distance from them of about 10 miles to the north-eastward. We derive our knowledge of the latter through the favour of Captain Livingston.

TULLOCH REEF.—In 1808, Captain Wm. Tulloch, of the brig *Equator*, of Portsmouth, New Hampshire, on a voyage from Madeira to St. Michael's, was alarmed by some of his crew's seeing breakers. After altering his course, he still saw breakers a-head, and as it blew too hard to be able to haul by the wind, and weather them, he determined, as his only chance, to endeavour to push through among them : accordingly, having taken in every sail, excepting the fore-topsail, he went to the fore-topmast-head himself, and coned his vessel safely through, by luffing up and keeping away, as he saw necessary. Captain Tulloch counted distinctly twenty-one heads of rocks, none of which appeared to have much water over them, and two of the rocks show occasionally above water, in the wash of the sea. Their extent, the captain thinks, did not exceed half a mile from North to South, and was still less from East to West. They bore E.N.E. by compass from the highest rock of the Formigas, then in sight, distant about ten miles, and appeared very black below water.

* Abstracted from remarks by Captain Nathaniel Simpson. The appearance of the Formigas is shown on our Chart of the Azores, &c.

The breakers on the Tulloch Rocks, have been several times seen since 1808: among others, by the *Ayrshire*, bound from the Clyde to Demerary. Mr. Ferguson, the mate of that ship, gives their situation as about *nine* miles E.N.E., by compass, from the Formigas.

Captain J. Henderson, commanding the ship *Fortescue*, from Mauritius to London, saw the Tulloch Rocks on the 17th April, 1829. Breakers were observed for half a mile East and West. The Greater Formiga and breakers in one bore W.S.W. (by comp.) the former about four leagues, and the latter two miles distant. There appeared to be several heads near the surface of the water. A westerly wind, and a heavy grown swell, prevented sounding.*

TERCEIRA.—This island is fertile, pleasant, and healthy; the lava districts here, as at St. Michael's, produce excellent vines, although not equal to those of the Canaries and Madeira. The land yields large crops of wheat and other grain, pasture for cattle, and a prodigious quantity of lemons, oranges, and all those fruits of hot and cold climates which are propagated to the greatest advantage in temperate countries. The capital, as already noticed, is ANGRA, on the south side of the island, having a harbour, defended by a fortress, in which resides the governor of the Azores. Angra is distinguished by several handsome churches, convents, &c. Besides this there is another town, *Praya*, and fifteen villages, all of which contain about 30,000 inhabitants. In the bay of Angra, and around the island, fish, of a good quality, are abundant.

The coasts are high, and so surrounded with craggy rocks, as to render the island almost impregnable: every accessible part being defended by batteries, with heavy cannon, and a numerous garrison. The interior is, in general, moderately high, but the western side is higher than the eastern, and is distinguished by a rugged mountain, extending nearly east and west, and of which, the western extremity, *Pico de la Serreta*, is the most elevated. This peak may be known by a great break on the eastern side, at a short distance.

The position of the city of Angra is shown in the Table, p. 34.

At the town, provisions are cheap, and in plenty. The bay may be readily known by means of a remarkable forked hill, near the sea, on the west side, named *Mount Brasil*;† and by two steep little islets, called the *Cabras* or *Goats*, which lie about 4 miles to the eastward of the mount. About 2 miles to the south-eastward of these islets, is another, called *Los Frayles*, with breakers near it.

In approaching from the S.W., South, or S.E., steer directly for Mount Brasil. Should the wind be adverse, when approaching the land, tack boldly without the bay, as there is a sufficient depth over it, and up to the shore.

But, beware of a calm, as the currents are very strong and variable. If you have not a leading wind, when sailing up toward the Mount, avoid too near an approach to the coast, between it and the westernmost part of the island: as it would, in a calm, be attended with the utmost danger; the coast being iron-bound, a ship driven on it would be in a most perilous situation.

ANGRA.—The BAY of ANGRA is open to all winds from S.S.W. by the South to the East. The swell from the S.W., in particular, which sets round Mount Brasil, on the western side of the bay, is tremendous. The ground, at the entrance, is foul, and ships

* A new and very beautiful brig, the *Zillah*, Martin, of Dundee, bound to Hayti, struck on a sunken rock "off the Formigas," at 10 o'clock, in the night of the 9th of April, 1832, and was abandoned at 3 p.m. of the next day, having then 7 feet water in the hold. About midnight she was seen to go down. Crew picked up and saved by the *Morley*, of London. (Qu. If not on the Tulloch Reef?) It seems remarkable that H.M.S. *Ariadne* should have been sent in search of these rocks, in the summer of 1829, without success. Of their existence there can be no doubt; although the position may be uncertain.

Captain J. D. Markland, of H.M.S. *Briton*, in a letter dated 20th February, 1832, writes, "I have-to for the night between St. Michael's and St. Mary's, being anxious to see the Formigas Rocks; and soon after day-light, with a thick morning, we fell in with a very dangerous shoal breaking heavily, and, as the fog cleared away, we saw the Formigas. When the rocks and the shoal were in one, the shoal bore from the rocks S.S.E. about three miles. This must be *Dollabaral's Shoal* above mentioned. The Formigas are properly placed.

† See the particular plan of the Road of Angra, on the Chart.

should always moor to the northward of Fort St. Antonio, which is on the west side of the bay.

The tides rise as shown in the Table, page 149. The flood sets in to the N.W.

Vessels may safely remain in the road in June, July, August, and September, when the winds are light, and prevail from between West and N.W. But, on the commencement of winter, the winds from the offing rage so violently, that, upon the least appearance of bad weather, it is requisite to put off to sea; the coast affording no shelter.

PRAYA BAY, or PORT PRAYA, on the eastern side of Terceira, has been described as the largest and safest bay in the Azores. "This bay," says M. Fleurieu, "has the form of a crescent; the point toward the North has, at its extremity, a small islet to the N.E. To lie in the best place, this islet must shut in with the point, and the two towers seen on the bottom of the bay must be brought together; you will be then in 24 fathoms, sandy ground, the town bearing N.N.W. and North. You may also anchor nearer to the shore, in 20 and 16 fathoms. The boats must not attempt to land at the bottom of the bay toward the S.W. on account of a sand-bank, upon which they would ground; but they will find a good landing place near the castle."

THE FOLLOWING is a more PARTICULAR DETAIL of the COASTS of TERCEIRA, abridged from Tofino.

The *Mount of Brasil*, near Angra, is moderately high, and has two small columns, or pillars, at the top, which serve as look-out places. The hill descends gently toward the north, and at its base, on that side, is the *Citadel or Fort of S. Juan*, the chief defence of the island, and particularly of the city of Angra, which stands to the northward and N.E. of it. From the citadel a line of wall and batteries extend to *Fort S. Antonio*, on the east side of Mount Brasil; the opposite or N.E. side of the bay is defended by *Fort S. Sebastian*.

Merchant-vessels regularly anchor in the line of the forts S. Antonio and S. Sebastian, or rather farther in, mooring with the four anchors. This is necessary, the bay being open to the sea from S.S.W. by South to East, and therefore extremely unsafe when winds from those quarters may be expected, the coast being mostly of sharp rocks. Large ships anchor to the eastward of Mount Brasil, in from 30 to 40 fathoms of water, sandy bottom, and they must be ready to get under way in the instant that the wind appears to be coming on from the south-eastward or south-westward.

On the western side of the castle of S. Sebastian is a little beach, slightly sheltered by a wall of the castle. It is called *Puerto de Pipas*, and is the spot wherein fishing-vessels are secured, by grounding them on the sand. It may serve as a landing-place when the sea will not allow you to land at the mole.*

The boats of the island come out so soon as any vessel is seen to anchor, and by them supplies may easily be obtained, even while keeping under way, tacking in and out, as they will bring water, wood, and all kinds of provisions.

The *Ponta de Las Contiendos* is the S.E. point of the island. It presents an eminence, having three peaks on its summit. At about half way between this and Angra are the *Cabras* or *Goats*, already noticed, which lie S.E. by E. [*E. by S.*] 4 miles from the summit of Mount Brasil, and two-thirds of a mile from the nearest part of the coast. Of the two islets, the eastern is the largest and highest: when seen from the east or west it appears like a wedge. Between the islets is a channel for row-boats, with from 8 to 10 fathoms of water: between them and the coast a ship may pass, as there are 9, 12, and 13, fathoms of water, with sandy bottom, and rocks near shore only.

The *Frayles*, or Friar's Isle, before mentioned, is a low islet, having two pyramidal peaks. A shoal extends from the S.E. side of it, about a cable's length, over which the sea breaks. Several cliffs on the islet give it the appearance, at a distance, of several isles. A ship may pass, with all safety, in the channel between this and the *Cabras*, the depths being from 60 to 75 fathoms, gravelly bottom, and clear ground.

The Eastern Coast of Terceira is generally broken, rocky, and dangerous. The eastern-

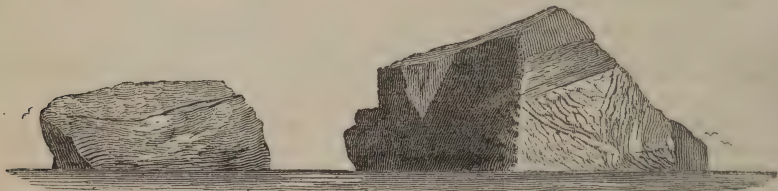
* It is sometimes much easier to land on the rocks under the cliff, on the Mount Brasil side of the bay, than at *Puerta da Pipas*. A footpath, of difficult ascent, marks the proper spot to attempt landing at.—A. L.

most point is that named *Malmeranda*, which is high and oblique, with a large shoal near to it, which shows itself at low water. To the south-westward of this point is the town of PRAYA, defended by batteries. The bay on which this town is situate is of great depth, with good holding-ground, and a fleet may anchor here, sheltered from the south, by the west, round to north, but entirely exposed to the eastward: the safest anchorage therefore is, with Point Malmeranda in a line with the northern islet Cameiros, and the highest tower or steeple of the town, which is the northernmost, open to the west. Here is a depth of 25 fathoms, with sandy bottom: and, as at Angra, supplies may be obtained from the boats of the place.

REMARKS ON TERCEIRA, by Captain Livingston, 1822.—“At about six and a half or seven miles north of Angra, in a valley near the summit of the mountains, a great deal of steam issues from crevices of the earth, or rather clay, which clay, I am informed by a scientific gentleman here, is actually lava, decomposed by the action of sulphuric acid. Some of the clay looks, when cut by a knife, much like Castile soap: it is of various hues, and the natives of Terceira use it as paint. There are small quantities of sulphur formed around some of the apertures. The steam which rises is very hot: we cooked some eggs by laying them among the clay, at mere cracks whence steam issued. My thermometer ranged only to 152° of Fahrenheit's scale. I exposed it to the steam at the first aperture I reached, but the mercury rose so rapidly, that, from fear of bursting the tube, I was obliged to withdraw it in, I think, about three or four seconds. Persons visiting Angra, who have any curiosity in their composition, should see this *furnaso* or *souffriere*. The access to it is by no means very difficult, though, if you ask any of the Portuguese, they will describe it as accessible only at some periods of the year. One may ride to within less than half a mile of it. Poneys, or asses, and guides, may readily be hired.

“The CITY of Angra is generally very regular, the situation beautiful, and the streets have regularly excellent flagged foot-paths. The houses are commonly of three stories. Mount Brasil, on the land-side, seems strong; and Fort St. Sebastian, on the Puerta Pipas side of the bay, is a small but strong fort. These fortifications were erected by the Spaniards when they were in possession of the island.

“Some vessels, mistaking Praya for Angra, have stupidly run in there; but the Goats and Mount Brasil are sufficient to show the most entire stranger the difference: I annex a sketch of the former.



The GOAT ROCKS; as sketched at 9h. a. m. 25th January, 1822, when about two miles distant; the weather being hazy, and the tops of the mountains of Terceira covered with dense masses of clouds. Point at the " bearing N. by E. by compass, and that at " " N.E. $\frac{1}{2}$ N. also by compass.

“No vessels should go to Angra without two good chain cables: the bottom in the bay being generally too foul for any trust in hempen cables.

“The better sort of people in Angra (natives) are very hospitable and kind, but full of ceremony. The poor people are generally very clean, and none seem in want of the necessities of life. None of that wretchedness which we so often see in this country is visible; but many of the older peasants have their clothes, though clean, so industriously patched, that it is next to, or altogether, impossible even to conjecture of what colour they originally were.

“There are some fine pine-woods in the island; a good deal of boxwood, and some cedar. Plenty of juniper, the berries of which are so very strong, as to leave, for a long time, a very unpleasant flavour in the mouth after chewing them. There is plenty of pumice stone, but of a coarse quality, in the island, and every where marks of volcanic agency are apparent. Water is good, but it is not so easily procured as might be supposed.

“The

"The Terceira fruit (oranges) has improved much of late years; more attention having been paid to its culture, and it is now little, if at all, inferior to the St. Michael's.

"Very good linen is made in the island, and they manufacture a coarse earthen-ware the clay of which it is made being imported from St. Mary's. No noxious animal is known; nor, though there are many dogs, has hydrophobia ever made its appearance. The natives rear a great many swine, most of which are remarkably broad-backed. Their backs are generally shaven, which, it is alleged, allows them to spread in fattening.

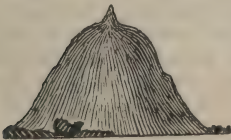
"Bloody flux is very frequent, both among strangers and natives, and is often fatal. A Scottish surgeon there told me it was the worst disease he met in the island.*

"Vegetables are excellent and cheap. Poultry and eggs good and reasonable; beef and mutton tolerable, the former about three-pence per pound. Some of the island wine is tolerably good.

"I was surprised to see a pretty fair bunch of bananas one day carried by a peasant. They have apples, pears, figs, chestnuts, and walnuts, and, I have heard, some olives, with abundance of grapes. Gooseberries and currants, I am told, have been tried, but have not succeeded. They have a very fine tough willow, which makes excellent hoops and baskets; also plenty of yams, Indian corn, wheat, and excellent barley, also tolerable potatoes. The market is generally well supplied with good and cheap fish. Rabbits and quails are plentiful: thousands of black birds, fine turkeys; few or no geese; no peacocks and no pheasants; a few red-legged partridges; and, I have heard it positively asserted, that there are some grouse on the mountains, yet I doubt the fact. There is a good deal of orchilla weed, which is of a grayish colour, sometimes slightly tinged with a reddish hue, and famous for producing the violet or crimson dye. It is monopolized by the government."

The NORTH COAST of TERCEIRA should not be approached by a stranger, as it is rocky and dangerous. The western coast is also inaccessible. Near the S.W. point is the Pico de Santa Barbara, a small but remarkable mountain, with a Vigia, or Look-out, on its summit.

PICO.—This island derives its name from the remarkable peak or volcanic mountain which stands upon it, and which appears, when seen over the southern coast of Fayal, nearly in the form represented on the margin. The summit of this mountain, whose sides are neither very steep nor uneven, is terminated by a small sugar-loaf, so very regular that one would think it had been made by art. The height of the peak above the level of the sea, according to the geometrical operations of the French astronomers, is 1100 French toises (about 1172 English fathoms); and, consequently, in clear weather, it can be seen 24 or 25 leagues off; but it is frequently so obscured by clouds, as not to be seen at any distance.† When the southernmost point of Fayal is in a line with the peak, E. by S. this mount appears as shown above.

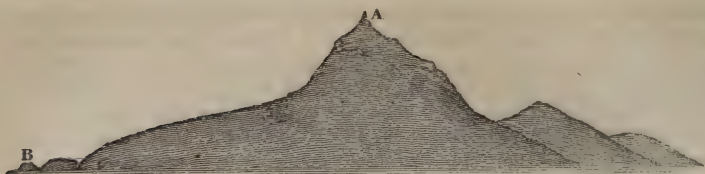


The peak has been described as filled with dark volcanic caverns, which have frequently emitted smoke, flames, and ashes, to a considerable distance. At the foot of the mountain, toward the east, is a spring of fresh water, generally cold, but sometimes so heated with the subterraneous fire as to rush forth in torrents, in a boiling state, and sending forth a stream of sulphureous vapours, vitrified stones, &c.

* It deserves to be known that the size of a hazel-nut of Castile soap, scraped fine and dissolved in about three wine-glasses of boiling water, to which add half a wine-glass of good spirits and a few lumps of white sugar, scarcely ever fails of curing bloody flux. Two or three doses may be required. I have tried it on myself and others, with perfect success.—A. L.

† The Spanish surveyors have since given the height of the peak, from its observed altitude, above the level of the sea, as 1212½ Spanish toises (1103 English fathoms only.) The mountain, they observe, covers the whole of the western part of the island; its skirts, and even half-way up, are covered with vines; the next fourth part by shrubs; and the last and highest part seems all of rock, covered with a very short grass. An ascent to the summit may be made, though not without difficulty, and some caverns afford occasional shelter.

Upon the supposition that the height last mentioned is correct, when the summit of the peak appears at one degree above the horizon, its distance will be 50¾ miles; at two degrees, nearly 32 miles; at 3½°, 19¾ miles; at 5°, more than 14 miles; at 6½°, nearly 11 miles; at 8°, nearly 9 miles; and at 10°, nearly 7¼ miles.



Pico, when the Peak (A) bears E.S.E. by compass.—(B,) E. by S.

Pico contains about 22,000 inhabitants, who occupy three towns and eleven villages. The soil being stony, little grain is produced, and the greater part of the wheat and maize, for consumption, is imported from the neighbouring islands. The wine is the staple commodity, and is reputed the best in the Azores. This, with brandy, is exported in considerable quantities. The cattle are various, numerous, and excellent; fruit is abundant, and equally fine. Besides these they have cedar and other timber, including a beautiful kind of yew, called *Teiro*, which is remarkably solid and fine; but which is monopolized by, and felled only by order of, the government.

The *vino tinto* of Pico, made from the Oporto vine, propagated in Pico, Captain Livingston thinks excellent; but it is not plentiful. The teixo wood, he says, is the same as our yew.

For the position of Pico, see the Table, page 34. The principal towns and villages are Lagens, Pico, Santa Cruz, St. Sebastian, Pesquin, S. Rocca, La Playa, and Magdalena.

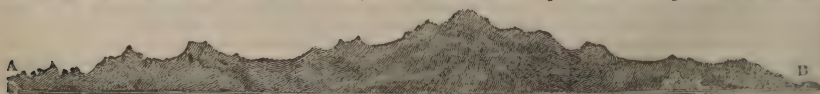
The S.E.³ point of the island, which is rather low and sloping, is named *Ponta de la Isla*; a ridge extends from it to the eastward, one cable's length. The next projection, on the south coast, is *Pta. de Caleta*, or Nesquin, distant 5 miles, W. $\frac{3}{4}$ S. true; between are the little harbours *Muelle de Manana* and *Nesquin*, fit only for coasters, which may ground on the sand, the bottom being generally rocky. At N.W. by W. [*W. by N.*] $6\frac{3}{4}$ miles from the Pta. Caleta is the *Pta. Arrife*, which is rather more elevated: the coast between continues rocky, and is not to be approached by strangers. Eight miles N.W. by W. [*W. by N.*] from Pta. de Arrife, is that of Santa Catalina; the coast between forms a slender bay, in which, at $2\frac{1}{2}$ miles from the former, are the town and lagoon of LAGENS; the latter communicates with the sea, by means of a bar, over which the coasters pass at high water. The fishermen have another place of shelter, in *Puerto Paima*, which is on the N.E. of the point of Sta. Catalina.

On the S.W. and West sides of the island is nothing remarkable but its rocky coast and islets. From the Pta. de los Baxios, on the N.W. side, breakers extend outward, to the distance of nearly a league, during a gale.

Off the most prominent part of the western coast are the little port and isle of La Magdalena. From the town, which stands here, the greater part of the produce of the island, for exportation, is shipped off for Fayal in small row-boats. The islets are surrounded with rocks; but very near the latter the depths are 6, 7, and 8, fathoms, rocky ground.

The north coast, from Pta. de los Baxios to the East end of the island, is altogether rugged, and may be considered as inaccessible.

FAYAL.—This island has been celebrated for its excellent pastures, fish, wood, &c. The air always mild and pure; the cold of winter never felt, and the heat of summer always tempered by refreshing winds. Its inhabitants are computed at about 17,000. The island produces wheat and maize, sufficient for itself and a part of Pico. The cattle reared here are not sufficient for the consumption of the island, and supplies are therefore sent from the neighbouring island of St. George, which produces a great number. The annual produce of wine is also scanty; for that which is exported hence is mostly from Pico, the opulent people of Fayal being owners of the best vineyards in that island, and they ship the wines from the port of Fayal for the different ports of Europe and America.



Fayal, when the point (A) bears N.E. by E. $\frac{1}{2}$ E. by compass, and (B,) E. by S.

The chief town is the *VILLA ORTA*, on the S.E. side;* and there are, besides, nine villages on the island. The bay, on which the town is situate, represents, according to M. Adanson, a beautiful amphitheatre, clothed with trees. The town has more than 5000 inhabitants, with numerous convents. The name Fayal is understood to be derived from *Faya*, the beech-tree, with which, and other wood, the island abounds.

In the journal of Mr. Keilor, an intelligent master of the royal navy, this officer has stated that those who run for Fayal should not depend on the peak of the next island as a guide, because it is sometimes covered for five or six days successively.

Mr. Keilor adds, Fayal has a good bay, opposite to Pico, which is formed by an isthmus, extending to the S.E., and a point about a mile and a half to the north-eastward; the town has several fortifications, but in bad repair. Water, in general, is bad and scarce. A number of vessels, of all nations, here load with wines, dye-woods, fruits, and cheese.

The following is the *DETAIL of the COASTS of FAYAL*. The S.E. point is a mount, with a hermitage on its summit, dedicated to *Our Lady of Guia*. (*N. S. de la Guia.*) The north side of this is connected, by a neck of sand, to a smaller mount, of a black colour, *Caimado*, at the foot of which the town of *ORTA* commences. Near the mount, on the west, is a sandy cove, *Port Pin*, where, in fine weather, some small vessels load and discharge their cargoes, but it is quite open to the S.W.

The northern point of the bay of Orta is named *Espalamaca*: its bearing and distance from that of La Guia is N.E. $\frac{1}{2}$ E. [*N.N.E. $\frac{1}{2}$ E.*] one mile and three-quarters nearly. At the bottom of the bay is a beach of black sand, which commences near Point Espalamaca, and terminates at Mount Caimado. Within it is the town, facing the sea. In the latter are two very remarkable buildings, nearly alike: one of these is close to the sea-side, and was formerly called the Company's College; the other is in the most westerly part of the city, upon an eminence, and is the Carmelite Convent. These objects in a line bear nearly N.N.W. [*N. 42° W.*]

Nearly in mid-channel, between Fayal and Pico, is a rocky shoal of $3\frac{1}{2}$ fathoms; it is about 20 fathoms in extent from N.E. to S.W. [*N.N.E. to S.S.W.*] and 10 broad. The marks for it are, the Company's College and Carmelite Convent, above mentioned, in one; Point de Espalamaca N. by E. [*N. by W.*] $2\frac{1}{10}$ miles; and the hermitage of Guia N.W. $\frac{1}{4}$ N. [*N.W. by W. $\frac{3}{4}$ W.*] a mile and six-tenths. See, farther, the particular Plan in the large Chart.

The regular *ANCHORAGE* of FAYAL is in the bay opposite to the town of Orta. It is the best anchorage in the Azores, on every account, excepting that it is open to the winds from North to N.E., and from S.E. to S.W., and these winds are frequent in winter. That from S.E. is very destructive, it blowing right in. Those who anchor, should, therefore, always be prepared for a start, on a shift of wind. The safest method is to let go the anchor in 35 or 40 fathoms, where the bottom is of sand, at about a mile and a quarter from the town, which will be with the Point of *Joaõ Diaz*, a little open to the right of Point Espalamaca, and the Company's College in the town a little to the southward of the Carmelites' Convent, already described. From this spot a ship may depart with any wind.

In the summer season, and favourable weather, the general anchorage is with the two buildings in the town as above described, but nearer to the town, in 25 fathoms, sandy bottom; small vessels proceed farther in, to 20 or 15 fathoms.†

To *SAIL* in for the Road, if from the *Northward*, no farther direction is requisite, as the way is perfectly clear. If, in coming in from the S.W., with a free wind, the regular passage is between the mid-channel shoal and Mount de Guia; or, if more agreeable, between the same shore and Pico, according to circumstances. With the wind from the West or N.W., take especial care to avoid the shoal, by observing the marks for it, above described.

If, on approaching the Road from the S.W., the wind should be dying away from the eastward, and you intend to tack, so as to gain the anchorage, keep over toward Pico, within the distance of a mile or a mile and a half; because, at a little farther out, the bottom

* See the particular Plan of the Channel between Fayal and Pico, on the Chart. For a farther description of these islands, see hereafter.

† Mr. Wm. Lane, agent to Lloyd's, in November, 1832, gave notice that, for the use of vessels passing through the channel between Fayal and Pico, or those requiring assistance from the shore, he had erected a flag-staff behind the castle of *St. Cruz*, Fayal, and provided the telegraph flags of Captain Marryat, so as to enable them to communicate any information they wish to be reported, or to acquire immediate assistance in case of distress.

is rocky, and you cannot anchor, in case of necessity : besides, by proceeding thus, you will be free from variable eddy-winds and calms, which are caused by the mountains ; and the coast is sufficiently clear.

SOUTHERN COAST of FAYAL.—The Point of *Santa Catalina*, which is $3\frac{3}{4}$ miles nearly W.N.W. [$W. \frac{1}{4} N.$] from Guia Point, is of low and black rocky land, and it, likewise, has a hermitage : between these points is the cove of *Feteira*, with its beach and village. Near it are several islets.

The point *Castelo Blanco* is the S.W. point of Fayal. It appears like a little round mountain of moderate height, sloped on every side, so that, at a distance, it appears like an island. The coast hereabout is rocky, and affords no anchorage.

At the west end of Fayal are the two islets named *Capelinos*, lying in a South [*S.S.E.*] direction. Between them and the coast is a channel, which, in fine weather, admits fishing-boats.

The point of *Jorge Lorenzo* is the northern point of Fayal. Its upper part is high and sloping. From this point to the N.E. point *Riveirina*, the coast trends S.E. [*E.S.E.*] Point *Riveirina* is high and sloped, and forms a round front, of about half a mile : at the foot of it is a low Point, with three islets. S.W. by S. [*S. by W.*] from this point, at $2\frac{1}{10}$ miles, is that of *Joaõ Diaz*, which is low, black, and rocky, with rocks at its extremity. Between the points the coast forms a slender bay ; the land is high and oblique, and it presents, near the middle, a remarkable slope of a red colour, which may be seen from the mid-channel shoal, called the Shoal of Fayal.

At nine-tenths of a mile to the southward from Point *Joaõ Diaz*, is that of *Espalamarca*, on the north side of Orta Bay. It is high and sloping, with a small round front, having a vigia, or look-out, on its summit. Between these points, the coast is a little indented, and has a beach, with a church, at the bottom of it. Trading vessels at Port Magdalena, on the opposite side, when assailed by violent winds from the southward, frequently bear up, and find good shelter here.

Numbers of handsome baskets are made of willows in Fayal, which are frequently exported to the adjacent islands. They are generally red and white, part of the willows being dyed of a scarlet colour.

ST. GEORGE.—This island lies at the distance of 3 leagues from Pico, and is separated from Graciosa by a channel 8 leagues in breadth. It is a long narrow island, about 9 leagues long, and little more than one in its average breadth. On its south coast is the little town called *Villa das Velas*, or *Vellas*, with a port where small vessels may lie sheltered from all winds.

This island, when Tofino described it, contained more than 11,000 persons, in three towns and seven villages. He says that it produces much wine of a good quality, which it exports to Terceira and America. The island has been famous for its cattle, with which it supplied other islands, and its cheese is said to be fine. The produce of wheat and maize is equal only to the consumption of a part of the inhabitants, as the lower class substitute the root of the iname. Wood and fresh water are abundant.

On the 1st of May, 1808, a dreadful volcano, seen from Fayal, burst out about the centre of this island, in the midst of fertile pastures, about 3 leagues S.E. of Vellas. On the 3d, a crater was formed, in size about 24 acres. In two days, it had thrown out cinders, or small pumice-stones, which a strong N.E. wind had propelled southerly ; and which, independent of the mass accumulated around the crater, had covered the earth from one to four feet in depth, half a league in width, and three leagues in length ; then, passing the channel, had done some injury to the eastern end of Pico. The fire of this large crater had nearly subsided on the 3d of May ; but, in the preceding evening, another small crater had opened, one league to the northward of the large one, and only two leagues from Vellas. The sulphureous smoke of the new crater rendered impracticable an approach to the large one. Within a mile of the crater, the earth was rent in every direction. The Fredonian consul of Fayal, who, with some friends, visited this place, stated that, “ they at length arrived within 200 yards of the spot ; and saw it in the midst of a pasture, distinctly, at intervals, when the thick smoke, which swept the earth, lighted up a little. The mouth of it was only about 50 yards in circumference ; the fire seemed struggling for vent ; the force with which a pale blue flame issued forth resembled a powerful steam-engine, multiplied a hundred-fold ; the noise was deafening, the earth, where we stood, had a tremulous motion ; the whole island seemed convulsed ; hollow bellowings were occasionally heard

from

from the bowels of the earth, and earthquakes were frequent. After remaining here about ten minutes, we returned to town; the inhabitants had mostly quitted their houses, and remained in the open air or under tents. We passed the night at Vellas, and next morning went by water to Ursulina, a small sea-port town, two leagues south of Vellas; and viewed that part of the country covered with the cinders before mentioned, and which have changed the most valuable vineyards in the island into a frightful desert. On the same day (May 4,) the party returned to Fayal; and on the 5th and succeeding days, from 12 to 15 small volcanoes broke out in the fields they had traversed on the 3rd, from the chasms above described, and threw out a quantity of lava, which travelled on slowly toward Vellas. The fire of those small craters subsided, and the lava ceased running about the 11th of May; on which day the large volcano, that had lain dormant for nine days, burst forth again like a roaring lion, with horrid belchings, distinctly heard at 10 leagues distant, throwing up prodigious large stones, with an immense quantity of lava, illuminating at night the whole island. This continued with tremendous force until the 5th of June, exhibiting the awful, yet magnificent, spectacle of a perfect river of fire, (distinctly seen from Fayal,) running into the sea. On that day, the 5th, its force began to fail, and, in a few days after, it ceased entirely. The elevation of the crater from the sea was about 3500 feet. The lava inundated and swept away the town of Ursulina, and country-houses and cottages adjacent, as well as the farm-houses, throughout its course. It, as usual, gave timely notice of its approach, and most of the inhabitants fled; some few, however, remaining in the vicinity too long, endeavouring to save their effects, were scalded by flashes of steam, which, without injuring their clothes, took off not only their skin but their flesh. About sixty persons were thus miserably scalded, some of whom died on the spot, or in a few days after. Numbers of cattle shared the same fate. The consternation and anxiety were so great among the people, that even their domestic concerns were abandoned; and, amidst plenty, they were in danger of starving. Supplies of ready-baked bread were sent from Fayal to their relief, and large boats to bring away the inhabitants who had lost their dwellings. In short, the island, heretofore rich in cattle, corn, and wine, is nearly ruined; and a scene of greater desolation and distress had seldom been witnessed in any country.*

The CHANNELS among the AZORES, are, in general, clear and deep, and may be navigated at all times: that, however, between St. George and Pico should not be attempted, unless in settled weather, or with a steady breeze, for a sudden calm may prove fatal; as a strong current runs through the channel, according to the state of the tide.*

The PONTA DEL TOPO is the easternmost point of St. George's Island. This point lies W. $\frac{1}{4}$ N. [W.S.W. $\frac{3}{4}$ W.] $30\frac{1}{2}$ miles from the summit of Mount Brasil, in Terceira. It is of moderate height, with rocks around it, and near its eastern part is a low islet, likewise surrounded by rocks.

From Pta. del Topo to Pta. del Norte Grand, the north coast presents nothing remarkable. There are several breaks in it, but it is mostly low and regular. Hence to the west end of the island, Pta. de Rosales, it is more rugged and barren. Off the point last mentioned are several islets, of which two very high pyramidal ones are remarkable; one of these is at the foot of the point, and the other half a mile to the S.W. of it. To the W. by S., *true*, of Point Rosales, the pilots say that there is a rocky shoal of 7 fathoms. The sea may break over it in a storm.

From Pta. de Rosales to the *Morro Grande*, (Great Hill,) near the port of Velas, the coast trends S.E. by S. [S.E. by E.] The Morro is high, of a blackish colour, and has a vigia, or look-out, on its summit. To the N.W. of the Morro, and on its skirt, is an indent of the coast, wherein several vessels have been lost, by mistaking it for the Port of Velas, the bottom being all rocky, and a vessel once in, cannot leave it without a change of wind.

PUERTO DE LAS VELAS.—At a mile and a half S.E. by E. [E. by S.] from the outer point of the Morro Grande is *Pta. la Caimada*, rather low, with a small castle. Between the two points is the Bay or Port of Velas, sheltered from winds from N.W., by the North, to S.E. In the bottom of the bay, on the shore, is the town of VELAS, or VELLAS, the chief town of the island; and on the S.E. side of this is a small mole, having 3 fathoms within it, but with rocky bottom. The regular anchorage is to the South [S.S.E.] of the mole, in 9

* And we suspect, too, according to the state of the Florida-Stream, especially when it flows from a high northern parallel.—Ed.

fathoms, fine black sand. Vessels moor with two anchors, to the N.W. and S.E. This is a place of little consideration.

From Point Caimada, on the eastern side of Port Velas, the coast by the sea continues low and rocky, but the land within rises to a good height. Thus it continues to the Pta. de los Monteros, the S.E. point of the island, which is high and sloped. Four leagues from the Bay of Velas is the *Point de Caleta*, whence a high mountain rises, with a gentle acclivity, and close to it, on the East, is a town of the same name, whence much wood is exported to the neighbouring islands.

GRACIOSA.—Graciosa is said to take its name from its beauty and fertility in corn, fruit, pasture, and cattle; supplying Terceira and several of the other islands with a great part of its produce. It is the most fertile of all the Azores, and has about 8000 inhabitants, distributed in two towns and two villages. The greatest extent of the island is only $8\frac{1}{2}$ miles; but, in this extent, the quantity of barley which is produced is almost incredible, together with wheat, maize, wine, all kinds of fruits and vegetables. Of sheep, hogs, and fowls, the inhabitants have more than they can consume. The only scarce article is wood, for this is obtained from St. George's and Pico. The chief town is *Santa Cruz*, on the N.E. side.

Ponta Blanca is the S.W. point, and Carapacho the S.E. The mountains over these points appear at a great distance like islands, particularly on approaching the south side from the S.W. Point Carapacho is low toward the sea, and has several islets about it; but at a little distance inland, it is high and craggy. At two cables' length S.E. [*E.S.E.*] from the point is the islet *Abajo*, with others in its vicinity; but between it and the point the largest ship may pass, should it be necessary, to the anchorage of *Praya*, on the eastern coast.

Between the point Carapacho and Ponta dos Fanaes, one mile and a half N.E. $\frac{3}{4}$ N. [*N. 14° E.*] the coast is almost uniform and clear. At the last, the bay of Praya commences, the north side of which is *Pta. Negra*; the bearing and distance between are N. $\frac{1}{2}$ E. [*N. 15° W.*] a mile and a half. *Pta. Negra* is low and rocky, and near it stands the town of *PRAYA*.

An islet, called the *Isle of Praya*, lies at half a mile East [*E.N.E.*] from Point Negra: it is low on the west side, but rather higher on the east, and there is a passage between it and the point. At the distance of a cable and a half to the southward of the islet is the anchorage.

At three miles North [*N.N.W.*] from Point Negra is the Point of Josef Ferrer, which is very low, being even with the water, and having a dangerous shoal, at about two cables' distance, to the East. [*E.N.E.*] The coast between these points is rather regular than otherwise, with a few little bights; of these bights, the first is close to Point Negra.

The best anchorage about the island is with the islet *Abajo*, lying near the S.E. point, in a line with the westernmost part of *Praya Isle*, or, rather, a little open; this is off the southern extremity of a great slope of land, extending toward the point of Josef Ferrer. The depths are from 30 to 40 fathoms, sandy bottom. Here vessels load and unload, and are ready to be off with any winds, but they lie sheltered only from South by the West, nearly to North. All the goods from the town of *Santa Cruz* are brought to this anchorage to be shipped, as they have no other.

On the west of the point of Josef Ferrer are the bay and town of *SANTA CRUZ*. The coast is low, and the land rocky, with scattered fragments of rock about it. Close to the town, on the S.W. side, are three small hills near each other, and a church is on the highest part of every one of them. These, therefore, are good marks for the north side of the island.

The *Ponta da Pico Negro* is the north point of the island: it is high, oblique, and of a very black colour. The coast hence to the S.W. continues high and rocky. From the *Pta. de Fosso de Porco*, the Western Point, half a mile S.W. by S. [*S. 10° W.*] is the Point of *Jorge Gomez*, low and rocky, with a church near it. Three miles and three-quarters from that point is *Point Blanca*, very high and sloping, within which, at a short distance, is the highest mountain on the island. The coast between is of high rock. On the summit of *Pta. Frayle*, northward of *Point Blanca*, is a stone that resembles a man.

At S.E. $\frac{1}{4}$ S. [*S. E. by E. $\frac{3}{4}$ E.*] $2\frac{1}{4}$ miles from *Point Blanca*, is the low and rocky point

point of Folgo; the coast between forms a bay, and the village of Folgo is at the bottom of it.

CORVO and FLORES.—These islands present nothing remarkable; they are of moderate height, intersected with hills, and may be seen, in clear weather, at the distance of 10 or 12 leagues. The surest guide will be an attention to their respective positions, as shown in page 34, and which will prevent their being mistaken for any other.

Mr. Luccock describes Flores as “a lively spot; it slopes to the east, and exhibits small enclosures, neatly walled and well managed; white cottages are every where scattered; the people are well made, ruddy, and healthy. They possess some of the social virtues; but even these lose their charms when accompanied by an unnatural simplicity and inanity of character. This, and its sister island, Corvo, when seen from the N.E., exhibit a singular appearance. The first resembles a large lizard, lying upon the water; the latter a tortoise; and the outlines and proportions of both are agreeable to nature.”

CORVO has a small port, and is said to contain about 750 inhabitants. Its produce is wheat, the best in the islands, rye, and yunsa, of which they make bread, mixed with the rye. Cattle, sheep, and hogs, are sufficiently abundant; but water and wood are scanty.

There is a mountain at each extremity of the island, so that the land, when viewed from N.W. or S.E., appears in the shape of a saddle. The southern point, *Pesquero Alto*, is low and rocky. At a mile and one-third E. $\frac{1}{4}$ S. [*E. by N.*] from this is the *Ponta de Puerto Casa*, of middling height; and close to the latter, on the north side, is the anchorage of *Puerto Casa*, in which there are 25 and 30 fathoms, good holding ground.

The whole of the eastern side is of high land, declining toward the sea. The north side is also high and sloping, but the coast is regular; nearly midway on this side is a rock, at a cable's length from the land, over which the sea breaks. Half-way down the western side is *Pta. Blanca*; the coast is here very high, with some declivity toward the sea.

At a mile and two-thirds from Point Blanca is the south point of the island, already noticed; the coast between forms a bay, in which is a small beach, connected to a high islet: W.N.W., true, from this is anchorage in 30 fathoms, sandy and good holding ground, sheltered from easterly winds.

In the CHANNEL between CORVO and FLORES there is a great depth of water: it has no shoal whatever, nor any hidden danger.

FLORES.—This island contains about 7000 inhabitants. It has two towns, both on the eastern side, *Sta. Cruz* and *Lagens*, and four villages. The chief productions are inames, wheat of excellent quality, cattle, sheep, and hogs, cloths, and woollen stuffs. The exports are wheat, cloths, bacon, with the weed or moss called orchilla, used for a dye, as already noticed. The latter is found clinging to the rocks and declivities, and is not obtainable without great trouble and danger.

The island is very mountainous, but much more so toward the south than the north. The town of Santa Cruz is in latitude $39^{\circ} 29'$; and to the N.W. of it, in the interior of the island, is a remarkable peak. The land is well cultivated, and has abundance of water, falling down, in numerous cascades, from the heights.*

Of *PONTA DEL GADA*, the north point of Flores, the position is shown in the Table, page 34. This point is of moderate height, smooth on its summit, not very projecting, but at its base is a cluster of islets, extending outward a quarter of a mile; the ground around them is clear.

PONTA RUIVA, the N.E. point of Flores, is high, sloped, rugged, and obtuse. At the foot of it is an islet, called the *Pan de Azucar*, or Sugar-loaf: a fishing-boat may pass between. In the bay to the westward of *Pta. Ruiva* there is anchorage in 25 fathoms, sandy ground, sheltered from winds from S.E. by the South, to W.S.W. It is frequently resorted to for water, or by vessels that are compelled by the wind to quit the eastern side of the island.

The *Point of Santa Cruz* is $2\frac{3}{4}$ miles S. $\frac{3}{4}$ E. [*S.S.E. $\frac{1}{2}$ E.*] from Point Ruiva. It is low and rocky, with several rocks about it. In the interval is the islet of Alvaro Rodriguez,

* The anchoring ground about the island is generally at without the distance of a mile from land. Within that distance the ground is rocky, and much farther out it is the same.

very near to the coast; and to the S.E. [*E.S.E.*] of this is anchorage, in 36 fathoms, sandy bottom, sheltered from the West and S.W. At true South, three-quarters of a mile from the point, is the castle of SANTA CRUZ, which is very near to the town, the principal port of the island.

At a mile and three-quarters southward from the castle of Santa Cruz, is *Ponta Cabeira*, low and rocky land, which rises with a gentle acclivity to the distance of a mile. Between these points the coast forms a bay, with a beach and a small river at the bottom of it. This bay is the best anchoring-place about the island, and is sheltered from all points between N.N.E. by the West to S.W. The proper depths are in from 35 to 40 fathoms, sandy ground. This is the nearest anchorage to Santa Cruz, and therefore the most frequented.

At a mile and a half S.W. $\frac{1}{2}$ W. [*S.S.W. $\frac{3}{4}$ W.*] from Point Cabeira is that of Loma, which is high and oblique; between these points the coast forms a bay, with a beach and small river at the end of it. A vessel may anchor in this bay, in 25 fathoms, sandy bottom, but it is not so well sheltered as that to the northward, being open to easterly and southerly winds.

From the Point of Lagens, which is four miles to the south-westward of Point Loma, a ridge of rocks extends to the distance of a cable and a half to the S.S.E. At $2\frac{1}{2}$ miles S. $\frac{1}{2}$ W. [*S. by E. $\frac{1}{4}$ E.*] from Point Lagens is a rock or shoal, of $4\frac{1}{2}$ fathoms: its size is about that of two ships, and appears, when near to it, like a large flagstone. Between it and the coast is a great depth of water, and the same about it.

In the little bay, on the north side of Lagens Point, is the town of LAGENS, having a large church, which is a useful mark for this part of the coast. A vessel may anchor very well in this bay with a wind between North by the West to S.W. by W. in 25 fathoms, sandy ground. This anchorage is much frequented, because a vessel can here get under way more easily than at Santa Cruz, having better room for working out.

From Lagens Point westward, the coast rises in height to the *Point de Roca Alta*, at a little distance from which, toward the north, is the highest part of the island. The Point of Lope Bas, which is nearly a mile W.N.W. $\frac{3}{4}$ W. [*W. $\frac{1}{2}$ S.*] from Lagens Point, is low by the sea, but within, high and sloping. That of Roca is a mile and a half farther, is obtuse, very high, sloping, and black. The coast here is nearly straight, high, and rugged.

The *Ponta de los Ilheos Agua Caliente*, which is low and rocky, is so called from a mineral spring which exists here, and of which the water is hot. Between this and the point Roca Alta is a bay, with anchoring ground in 25 fathoms, sandy bottom. There are several islets at the foot of the former point.

The *Pta. de Catarinas*, with its islets, lie a mile and a third more to the northward. The coast between is wholly rocky. At a mile and three-quarters farther, to N.N.E. is *Pta. dos Bredos*, high sloping land, of a whitish colour, with islets at its base. One of the latter, on the south side of the point, resembles a column. The coast between affords anchorage, in 20 or 25 fathoms, sandy ground.

The *Pta. del Baxio*, which is very low, is $2\frac{3}{4}$ miles to the northward of Pta. dos Bredos. The coast between is rocky, but you may anchor off it in 32 fathoms of water, sandy ground, and sheltered from N.N.E., East, and South. Close to Baxio or Shoal Point is a very remarkable church; that of S. Pedro, or St. Peter.

At $2\frac{1}{8}$ miles N.N.E. $\frac{1}{4}$ E. [*N. 6° E.*] from Baxio Point, is that of Fanaes, which is not very high by the sea, but it forms abruptly like a mountain, and is of a black colour. The bay in the interval is that of San Pedro, which has anchoring ground, in 25 or 30 fathoms, bottom of sand; and here water may be readily obtained from a cascade that falls from the mountains, by means of a hose, so as to fill the casks without taking them out of the boat. The islet Monchique lies at rather more than a mile N.W. $\frac{3}{4}$ W. [*W.N.W. $\frac{1}{2}$ W.*] from Point Fanaes. The depth between is sufficient for any ship.

PONTA ALBERNAS is the N.W. point of Flores. It is moderately high, sloped, and of a red colour. Between it and Point Fanaes is the islet of *Maria Gadella*, which is high and round. W. $\frac{3}{4}$ N. [*W. by S.*] from this islet is anchorage, in 30 or 40 fathoms, sandy ground. From the point eastward, to Pta. del Gada, already described, the coast is entirely rocky.

REMARKS on CORVO and FLORES, by Capt. J. Wallace Monteath.

On the 24th of June, 1824, I hauled up on a S. by E. course by compass, so as to pass within sight of Flores and Corvo, with a steady breeze from S.S.W. to S.W.

At 9 a.m., Flores was in sight, bearing by compass E.S.E. $\frac{1}{2}$ E., and forming, to appearance, two separate islands, (the southernmost end being considerably higher than the northern one,) but in running seven miles farther the central land was plainly seen from the deck. At this time Corvo was enveloped in clouds, and was not visible. At noon the latitude was observed, by circle and sextant, as $39^{\circ} 30' 30''$. The bearings by compass, at the time of observation, were—in Flores, Pta. del Gada, (the north point,) S. 67° E.; Punta de Roca Alta, (the south point,) S. 53° E.: in Corvo, Pta. de Pesquiرو Alto, S. 77° E.; Punta Turrias, S. 83° E.

The northern part of Corvo is high and steep, and without inhabitants or cultivation. The south point is low and rocky, and appears, at a distance, like a square fort. The whole of the north side is clear of rocks, and may be approached very near without danger. At 5h. 47m. the longitude by chronometers was observed as $31^{\circ} 10' 30''$ W., and the bearings by compass then were, in Flores, Pta. Catarinas, S. 15° W.; Pta. Ruiva, S. 5° E.: in Corvo, Pta. del Pesquiرو Alto, S. 45° E., and Pta. dos Turrias, S. 60° E.

These bearings give the longitude of Punta Delgada, in Flores, as $31^{\circ} 6' 0''$, and Pta. del Pesquiرو Alto, in Corvo, as $31^{\circ} 0' 30''$.

DESCRIPTION OF A VOYAGE FROM THE WEST-INDIES TO THE AZORES, in the *Hornby*, Capt. Walker, 1818. By Lieut. James Hackett.

On the 29th of April, 1818, at about three o'clock in the afternoon, we sailed from Basse-terre Roads (St. Christopher's), steering a N.W. course, with a gentle easterly breeze, and, with feelings of pleasure, to which we had long been strangers, observed the town and shipping gradually recede from our view, and diminish into obscurity. Shortly after dusk we were close in with Eustatius; and, on the ensuing morning (the 30th), the islands of St. Martin and Anguilla were discernible; early in the afternoon, Dog Island bore faintly in sight to the N.E., from which we took our departure, and bade a final adieu to the West-Indies.

Having now cleared every obstruction, and being once more afloat upon the wide Atlantic, we set all sail, and steered a N.E. course. With the exception of a few slight squalls, accompanied by much vivid lightning, we experienced an uninterrupted continuance of fine weather, and favourable though light winds, which enabled us to carry our studding-sails nearly the entire voyage to the Azores; which islands we made on the 26th of May, without having once had occasion to put the ship about.

So favourable a passage has probably been rarely experienced from the West-Indies, and was to be attributed, independently of the season, to our course, which varied considerably from that generally adopted by vessels homeward-bound from the Windward Islands. The masters of West-Indiamen, almost uniformly, in the first instance, proceed nearly due North until they reach the Bermudas, whence they take a fresh departure, and steer direct for England: but Captain Walker, aware of the incompetency of his crew to contend with the bad weather, heavy gales, and fogs, usually experienced off the Great Bank of Newfoundland, judiciously deviated from the customary track, and stood to the N.E. by E. (*true*), keeping the ship as close as she would lay to the southward and eastward; by which means he was enabled to fetch the Western Islands, so unfrequently touched at, except by vessels for the immediate purpose of commercial traffic.

Of these islands, the first land made was Pico, whose lofty summit was, by the ship's log, discernible at the great distance of 24 leagues; and, on our approach, the following day, presented an appearance inconceivably bold and majestic; its insulated situation, extreme elevation, and luxuriant scenery, combining to form a view of the most impressive grandeur.

The peak was seen proudly towering above massy clouds, which, hanging upon the steep sides of the mountain, at intervals occasioned a partial obscurity, and even sometimes appeared to envelope the base itself.

As we bore up abreast of the channel which separates the island from Fayal, the density of the atmosphere became less intense, and the clouds gradually dispersing, as the sun advanced above the horizon, the celebrated peak was shortly after visible in all its sublimity; a few light clouds still hovering around its summit, increasing the general interest of the scene. Its extreme height is generally estimated at upwards of 7,000 feet above the level of the sea, and cultivation appeared to have been carried to within about one-third of the summit. These lofty regions were not only unsubdued by human industry, but apparently destitute of even the slightest vestige of natural vegetation. Here nature reigned in the midst of the most picturesque and barren wildness, more strikingly interesting, as contrasted with the luxuriant fertility of the lower and inhabited districts. The entire island seemed devoted to the growth of the vine, which rendered its appearance rather gloomy and sombre; enlivened, however, by the white cottages of the peasantry, the monasteries, churches, and a few other elevated buildings.

Owing to the lightness of the wind, we were unable to make Fayal so early as we had expected, and it was five o'clock in the afternoon before we anchored in the road of Orta, the capital of that island. The prospect which unfolded itself, as we approached the harbour, surpassed in natural beauty any thing I had ever before witnessed; equal to the most highly cultivated pleasure-grounds in England. The island, throughout, exhibits a charming variety of scenery, and its features were, in many parts, in the highest degree romantic.

The weather being so uncommonly calm, and the sea free from the slightest ruffle, I attempted to make a few sketches, but never before more sensibly felt the inadequacy of my pencil to do justice to the captivating scenery which successively presented itself.

As the vessel sailed round the point, and entered the roads of Orta, the prospect was peculiarly fine. The town is built close to the shore, and, viewed from the harbour, has the appearance of considerable magnitude and importance, owing principally to the great number of religious buildings conspicuous in every direction; and which, on first appearing before the little city, give it an air of architectural magnificence, of which, with the exception of the monasteries, churches, and a few private houses, a more minute acquaintance proves it to be totally devoid.

Shortly after the Hornby entered the roads, the revenue-officers, attended by a strong military guard, came on board; but, after examining our papers, and going through the usual forms, retired, leaving two officers in charge of the vessel, and granting us unrestricted permission to go ashore whenever we pleased. Of this indulgence we soon availed ourselves, accompanied by one of the officers for a guide. It was now fast approaching to twilight, the evening serene, and the convent-bells chiming with the most plaintive solemnity for vespers. Our conductor led us through the principal parts of the town, pointing out the various objects deserving attention, and describing the different religious orders to which the numerous monastic structures, &c., respectively belonged.

The height of the houses seldom exceeds two stories, and these are built principally of a close blue granite or lime-stone, with which the island abounds: it is capable of being worked to any degree of ornamental richness, and can be raised in blocks of considerable magnitude, presenting, when wrought, a durable and handsome appearance. The windows, which, at the time of Captain Cook's visit, were merely latticed, are now universally furnished with glass; those of the second story have likewise trellis-work balconies generally attached to them, where the inhabitants usually resort to enjoy the mild and salubrious evening temperature. The principal street, which runs nearly parallel with the shore, and extends throughout the whole length of the town, is irregular, in many parts narrow, roughly paved, and without foot-paths.

Orta, although formerly a place of considerable strength, cannot at present be said to be well fortified, as the works have, in many places, been permitted to fall into decay. Its chief defence consists in three forts, two of which cover the principal landing-place at the south end of the town, and are strongly garrisoned: the other, situated at the northern extremity, appears to be of minor importance, and is less attended to. An old wall and rampart, nearly in a ruinous state, extends along the front of the town, ill calculated, in its present condition, to afford protection, and without a gun mounted on any part.

The monasteries and convents partake, principally, of the Moorish style of architecture, and consist chiefly of a lofty and ornamental white front, terminating in the centre in a curved line pediment, containing some emblematic religious device; a square tower at
either

either side, with circular-headed windows, black quoins, cornices, belting-courses, &c., and surmounted by Turkish or Arabic turrets. The rear presents nothing more than a plain building of rough masonry.

The Jesuits' college was originally a fine and graceful structure, but is now partly in a state of dilapidation; such parts as still remain habitable have been converted into government offices and king's stores. This building is situated on an eminence toward the north end of the town, and has an imposing appearance.

During our perambulations through this little city, the only interruption to the placid stillness of the evening was the tinkling of guitars, which proceeded from almost every house, and appeared to be the general pastime of the inhabitants. After nightfall the Portuguese seldom go abroad; the few we met were wrapped up in large blue cloaks, and walking with an air of the most solemn gravity. About ten o'clock we returned on board, but early on the ensuing morning again proceeded on shore. This being market-day, the peasantry were crowding in from all parts of the island with various articles of provision, consisting of butter, eggs, poultry, &c., which were to be had remarkably cheap. The men exhibited much of the appearance of the hardy mountaineer, inured to the fatigues of toilsome and laborious industry. Cleanliness, good order, and contentment, seemed to characterise the women, whose peculiarity of dress, healthy appearance, and apparent artlessness of manners, gave them an air of the most interesting rustic simplicity.

I was informed that the inhabitants of Fayal, and of the Azores in general, enjoy a life of the most social and domestic happiness; and are far superior, both in elegance of manners and liberality of sentiment, to the generality of Portuguese resident on the continent of Europe. On proceeding a short distance into the interior, the scenery fully justified my prepossession on landing. The luxuriant evergreen *Faya* (from which the island is said to have derived its name) grows unheeded in almost every direction. The gardens possess a combined assemblage of tropical and European trees; that of the American consul was a perfect little paradise, presenting the interesting novelty of the orange and banana flourishing in the same soil beside the apple and other fruits of common English growth. The different compartments were enclosed by hedges of geranium, bearing a full-blown scarlet blossom, in appearance particularly rich and beautiful.

An intimation from Captain Walker, that the vessel was ready for sea, precluded the possibility of extending our excursion so far into the island as we intended, and with much regret we were compelled to return on board.

Through the zealous attention of the British consul, (Mr. Parkins,) who procured for us during that day every necessary we stood in need of, the Hornby was, by five o'clock in the afternoon, cleared out, and once more ready to proceed on her voyage. About six we weighed anchor, and steered a N.E. course, close by the west point of the island of St. George; next morning observed Gracioso bearing E. by N., at 11 o'clock passed within four miles of it. Its general appearance was rather barren, presenting a brown turf-like soil, and much covered with heather; toward the S.W. end, the shore bluff and rocky, against which the sea beats with much violence, and breaks to an immense height; the interior of the island is mountainous.

4. THE ISLANDS *of* PORTO SANTO *and* MADEIRA.

PORTO SANTO, &c.—Ships from the ports of Europe, when bound to Madeira, are recommended to make, in the first instance, the Isle of PORTO SANTO, and thence proceed for the Road of Funchal, on the track shown upon the particular plan given in the Chart. The land of Porto Santo is very remarkable, and may be seen, in fine weather, 15 or 20 leagues off. It first appears in two or three very high hummocks, by which it is distinguished from Madeira, and the little isles named the *Desertas*. On the S.W. side is a small town and good road, where water and refreshments may be had. This road is described as, in some respects, better than that of Funchal. The position of the isle is shown in the Table, page 35.



Porto Santo (a) bearing South, 14 miles, as taken by Captain J. W. Monteath.

Of PORTO SANTO, the highest hills, which are perfectly barren, stand at the two extremities of the island, being divided by a central valley or plain.* The whole has a parched burnt-up aspect, especially after harvest: yet a considerable quantity of corn is grown on the level land, and near the town, on the S.W., a narrow band of vines stretches along the shore; the plants are not trained, but drawn on the hot sand, and the fruits thus ripen earlier than at Madeira. The island has but one fountain of good water; it is on the north side, and conducted to the town by a *levada*. The other springs are all brackish.

With the exception of a few pines and palms, Porto Santo is destitute of wood. There is not even brush-wood. For fuel, therefore, the inhabitants depend on Madeira. The town is insignificant, and the island is occasionally used as a place of exile from the same place. The population is estimated at about 1200 persons.

Large boats trade between Porto Santo and Madeira. Between the two isles the prevailing wind is generally from the N.E.

To the northward of Porto Santo there is a ledge of rocks, the position of which was ascertained by the officers of his Majesty's sloop *Falcon*, Lieut. J. Bowen, in January, 1802. The least depth upon them, according to the observations then taken, is $4\frac{1}{2}$ fathoms. They are steep-to, and lie at the distance of 8 miles from the northernmost point of the island, with the N.E. point of Porto Santo bearing S.S.E.; the Ilheo da Fonte, or northernmost rock, S. by W., and the west point of the island S.S.W.

The bank extends east and west, *true*, nearly a mile and a half, terminating in a reef to the westward. The shoalest part, supposed to be a pinnacle rock, lies as above, or *nearly so*, the boat in which the bearings were taken being agitated by the sea.

There can be little doubt that this is the reef, formerly said to lie 3 leagues to the N.E. of Porto Santo, on which a Dutch ship was lost.

A bank of rocks, on which the least depth is 40 fathoms, lies about three miles to the E.S.E. of the Ilheo de Serra, the south-eastern islet of Porto Santo.



Porto Santo (a) N. by E. 12 miles; taken by Captain Monteath.

DESERTAS.—The little isles, called the DESERTAS, on which there are a few fishermen's huts, are barren fragments of rock and earth, represented as lying nearly in a North and South [N.N.W. and S.S.E.] direction.

There are three of them, all very difficult of access, both from the heaviness of the surf on the beach, and the steepness of the cliffs. The interior surface of the Great or Central Deserta forms a hollow or valley, and is composed of loose rock, destitute of vegetation. Sea-fowl abound; and a guard of three soldiers, to prevent smuggling, is kept here.

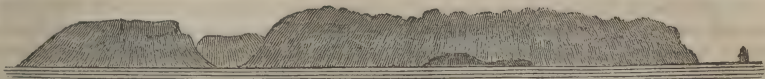
The Table or Northern Deserta (*Ilha Chao*) is comparatively low and flat. It is generally covered with marine grass, and is farmed for the sake of the *lichen roccella*, or orchilla weed, which it produces. Here is, also, great plenty of shell-fish,—limpets and *cracas*, which are collected for the Funchal market. Rabbits, too, abound; and the stormy petrels, or Mother Cary's chicken, hide in the rabbit burrows.

At the distance of 10 leagues, and bearing W. by N., the Desertas appear separately: the middle one long, high, and nearly even: the southernmost, called the *Bujio*, in two hummocks, nearly as high, and about two-thirds of the length of the former. At the distance of 6 or 7 leagues, the northern islet becomes discernible, like a low wall: close to this is a high rock, the *Pyramid*, frequently mistaken for a ship under sail. Several outward-bound West-India ships were dashed to pieces, a few years since, by running on the Desertas in the night; the consequence of an error in dead-reckoning.

Between the Desertas and Madeira is a clear passage, eight miles broad, having no soundings, except at 50 or 60 fathoms, almost close over on the Madeira side. In the season of the breezes, (the N.E. winds, which prevail in summer), a strong current sets through this passage to the south-westward.

* The highest hill rises to about 1600 feet above the sea. Bearing S.W. by W., 12 leagues, Porto Santo appears like two islands, detached and at a distance from each other.

The passage between the larger Desertas is clear, though bounded on each side by breakers, or rather by a surf; but it should not be attempted, unless from necessity, as it is very narrow, and has no soundings, or at least very deep water, in it; and a ship is subject to be becalmed in it by the northern Deserta, which overlaps the Bujio. This happened to a vessel of about 200 tons, which came through it in the night, having mistaken it for the broad passage to the northward.



The Southern Deserta S.W. by W. 6 miles; taken by Captain Monteath.

MADEIRA.—"Madeira may be shortly described as one mass of mountain, rising to the highest summits in the centre, descending on the north to a range of lofty cliffs, bounded by the ocean, and to a lower and gentler character of coast on the south. The island is riven throughout with deep ravines and valleys, which radiate to the sea in all directions." The cultivation is confined to the coast, or to the bottoms of some of the valleys, and occupies altogether a very small proportion of the surface. Vines form the chief feature; for the corn grown annually scarcely supplies a two months' consumption to the inhabitants.

The whole coast of the island presents a range of cliffs or headlands, varying in altitude from 200 feet to nearly 2000; for the most part of a dark volcanic aspect.

In the island may be found almost every European and tropical luxury. The myrtle, the geranium, the rose, and the violet, may be seen on every side. The geranium, in particular, is so common, that the honey of the bees is strongly impregnated with its odour.

Nearly all the productions of the tropics are cultivated here with success; and the guavas, citrons, bananas, and custard-apples, are even considered as superior to those of the West-Indies. The vegetables are the same as those of England, and generally of much the same quality. The same garden which supplies the dessert gives likewise the coffee which closes it, and of the finest kind.

The population of the island, in 1826, was estimated at 102,000.

At Madeira is a wind called the *Leste*, which, as its name implies, comes from the East, although all East winds are by no means *Lestes*. It appears to be of the same kind as the *Harmattan* of Western Africa, and is of a hot, close, drying nature, particularly oppressive to some constitutions, whom it affects by languor, head-ache, and a parching of the skin and lips. What is remarkable, the residents are those whom it most disorders in this way. Visitors, in general, suffer much less; and the invalids are never so well as while it lasts. A peculiar clearness and cloudlessness in the atmosphere are among the invariable indications of *Leste*, and the weather during its continuance is most delightful; the sky of a deep blue, so stainless, that one might fancy it had never been sullied by a cloud; with a transparency in the atmosphere which, like the effect of moisture, seems to bring out fresh hues from every object.

At times, but not frequently, the *Leste* is accompanied by a strong wind, but the weather is still delightfully warm and pleasant. The nights, too, are delicious; soft and balmy; and with the moon shining in summer brightness, and the orange trees in flower, the air is loaded with perfume. With the departure of the *Leste* rain almost invariably follows.

The climate, generally, is delicious, and strikes with peculiar charm to a stranger, whom a short sail has transferred to it from the very midst of the gloom and chill of an English December. Indeed the great natural distinction of Madeira is the climate, which, perhaps, taken altogether, is the finest in the world. The bitterly cold winds which, during some seasons, prevail on all the shores of the Mediterranean, are never felt at Madeira. Of winter there is, properly, none; a peculiarity not so remarkable as the fact of the comparative mitigation of the summer heat; which, except in particular situations, hardly exceeds that of an ordinary hot season in England. The perfection of the climate consists in this uniformity of its temperature. It differs, perhaps, less in summer and in winter than in any other spot north of the tropic. The thermometer commonly ranges from 60 to 75; and, in the greatest extremes, seldom sinks or rises more than five degrees below or above that medium.*

Although

* The mean temperature, from observations during eighteen years, has been given as follows:—
January,

Although thus in the enjoyment of an almost continual spring, the island is singularly free from the annoyances and inconveniences that so commonly infest warm climates; and which go far, in fact, to overbalance all the luxury derivable from the temperature itself. Here are no periodical fevers; and, what is more remarkable, no snakes nor noxious reptiles of any kind; nor scarcely even a gnat.

Water, of excellent quality, is abundant. Springs are found every where, and copious; even the streams at the bottom of the ravines, fed by the mountain-mists, are never dry in the hottest season; and the height from which they descend enables the inhabitants to divert the course of the water at any elevation or in any direction; the whole cultivated region, therefore, is irrigated on all sides by these *levadas*, or water-courses. On the coast fish is abundant, and forms an important article in the food of all classes.

The only corn grown is bearded wheat and barley, and of this not more than is equal to two months' consumption in the year. That mostly imported is from the ports of the Baltic. *Milho*, or maize, is the principal food of the lower orders, and is imported chiefly from the Mediterranean. Timber and pipe-staves are from America.

The towns and villages are invariably situated on the sea-coast, and commonly at the outlet of a ravine; but where the bottom is fertile, and the surface permits, the cabins and *quintas*, or country seats, are often scattered up a considerable extent of the valley.

The capital of the island is FUNCHAL, on the S.E. coast. This place is not handsome, and strangers commonly consider it as ugly and inconvenient. It is true that the streets are generally both steep and narrow; the former is rather the fault of the island, the whole coast of which is described as scarcely presenting an acre of plain surface; and as for their narrowness, it must be recollected that they are not like those of any other place, intended for the passage of wheel-carriages; such a machine being unknown here; but for foot-passengers or horsemen, the streets of Funchal are wide enough, especially under so sunny a sky, and they are now generally clean. Their very steepness contributes to this quality, assisted by a copious little runnel of water, which is generally seen coursing down the middle to the sea; and the sound and sight of which are particularly grateful.

The houses are commonly low, not often exceeding one story in height, and have generally an agreeable look of whiteness and neatness in the exterior. Those belonging to the *fidagos*, or the richer merchants, are large and handsome. There is no public edifice of any consequence. The governor resides in the castle, a large, irregular, half-modernized mass of gothic building, situated near the beach. All the houses have at the top a kind of *gazabo*, or belvedere, of more or less elevation above the rest of the building, which they call *torrinhas*, or turrets, and as the city is built on a rapid ascent, from the shore, these lanterns always command a view of the harbour. The great object of resort to these turrets is to look out for vessels; the first thing to be done in the morning being to mount the turret, to see if any vessel had arrived in the offing in the course of the night. It is curious, says the writer, what a degree of accuracy in the distinguishing of ships at a distance, is acquired by this habit of watching them. Every merchant's house has private signals, which are hoisted by the vessels respectively consigned to them; the destination, and even the name of which, is thus commonly known before they reach the bay.

A late voyager says that, on advancing slowly into the Bay of Funchal, early in the

January, 64°.18; Feb., 64°.3; March, 65°.8; April, 65°.5; May, 65°.53; June, 69°.74; July, 73°.45; Aug. 75°.2; Sept. 75°.76; Oct. 72°.5; Nov. 69°.8; Dec. 65°. The year is, therefore, one summer, with comparatively little alteration either of temperature or hue.

"In fine weather, and it is fine at Madeira nine months in the year, the view of this steep and lofty island, covered with bright verdure, and enlivened by numerous scattered houses, as white as snow, is very striking to a stranger who arrives from the low and tame-looking shores of the south coast of England.

"Seamen are often deceived, when about to anchor in Funchal Roads, in consequence of the sudden transition which they have probably made from a low shelving coast to an abrupt and high mountain side: for the bottom of the anchorage slopes away as suddenly as the heights overlooking it, and the anchor must, indeed, be let go upon the side of a mountain. Hence ships seldom go close enough, unless guided by a person who knows the place; and many a chain cable ran out to the clinch, when chains were first used, owing to an incorrect estimate of the vessel's distance from shore and not taking time to sound accurately.

"Closing the land quickly, after passing some time at sea,—approaching high cliffs or hilly shores, after being, for a time, accustomed to low coasts,—or nearing a flat shore, after the eye has been used to precipices and mountains, almost always is a cause of error in estimating distance, however experienced a seaman may be."—*Captain Fitz-roy*, vol. ii. p. 46.

morning

morning of the 1st of January, 1825, the town, the country houses, and *Nossa Senhora do Monte*, glistened like silver through the thin mist which floated on the bosom of the mountains. The bells of many churches soon began to hail the new year with that blessed sound which mariners, above all others, love to hear.

The town of Funchal stretches along the margin of the bay for nearly a mile. It is, by no means, so dirty as formerly. The cathedral is a fine building: before its western door is a *parvis*, or open space, and beyond that the *Terreiro da Se*, a very pleasant promenade, under four or five parallel rows of trees, and enclosed by a wall, a few feet in height. Some pretty houses are situated in the street on either hand, from the balconies of which the ladies look at the gentlemen below. Beyond the *Terreiro* is the market-place, which is very clean, and regularly laid out in streets and stalls: the latter roofed.

The church of *Nossa Senhora do Monte* is the neatest in the island. It is seated on a terrace just half way up the mountain, and commands one of the most enchanting views in the world. The *quintas*, or country residences, of the English merchants are delightful, and it is pleasant to spend a Maderian afternoon in riding about, with good company, from one to another. The English church, on the skirt of the town, is an elegant and convenient building, literally embosomed in ever-springing roses and white daturas.

The *Corral* or *Curral* of Madeira, a few miles north-westward from Funchal, is one of the grandest scenes in the world. It is finely described in the volume entitled, "*Six Months in the West Indies, in 1825.*" A friend who had visited Switzerland said that, in the Alpine country he had never seen any thing so wonderfully sublime as this place. It is a huge valley, or rather crater, of immense depth, enclosed on all sides by a range of magnificent mountain precipices, the sides and summit of which are broken into every variety of buttress or pinnacle,—now black, and craggy, and beetling,—at other parts spread with the richest green turf, and scattered with a profusion of the ever-green forest-trees, indigenous to the island; while far below smiles a fair region of cultivation and fruitfulness, with a church and village, the white cabins of which seem half smothered in the luxuriance of their own vines and orchards.*

The BAY of FUNCHAL is formed on the west by the *Pico* and *Punta da Cruz*; on the east by *Cape Garajao*, or the *Brazen Head*. The last, is, by no means, the loftiest of the neighbouring cliffs; but as, by its projection, it forms the eastern horn of the bay, it becomes an object of constant attraction to all vessels from Europe having to round its point.

PUNTA S. LOURENÇO is the easternmost part of Madeira. This point is a long narrow ledge of rock, about 6 miles in length, but in no part one in breadth. Its surface is exceedingly varied, but its general tendency is that of declivity from the cliffs and peaks on the north side, to a low rocky shore on the south. The cliffs and peaks, though lofty, are not nearly of so great elevation as those of the island in general, but are of a much more broken and fantastic character. Here and there a patch of herbage only affords scanty pasture to a few sheep or goats.

CAMERA DE LOBOS, a diminutive old town, stands at nearly 5 miles to the westward of Funchal. Here a ledge of black basaltic rocks projects and forms a kind of shelter for its little harbour. This place is interesting as the spot where the Portuguese discoverers first made their landing in 1420. In itself it is poor enough, but the sides of the mountains around are covered with *quintas* and vineyards, and are said to form one of the finest wine districts in the island. To the west of the town the cliffs begin to rise rapidly, till at no great distance, they accumulate into *Cape Giram*, a magnificent headland, the loftiest of the island, being not less than 1600 feet above the level of the sea, which washes its base.

Beyond *Cape Giram* may be seen the perpendicular and majestic cliff called the *Ponta*

* Capt. W. F. Owen says that the *Curral* means simply a sheepfold, and is an immense valley, completely surrounded by hills, whose sides are literally perpendicular, in no part being less than 1000 feet high. Round a part of these cliffs is a narrow road, leading to the garden houses and country plantations, cut out of the rock, about 10 or 12 feet wide. On riding along the road over the *Curral*, it seems like an unfathomable abyss, filled only by clouds and vapours, rolling in a constant motion over each other.—Voyage, Vol. I., p. 11.

Captain Owen adds, that "Funchal is, from its situation on the side of a hill, very clean, and has various marks of opulence and industry. The peasants are an athletic and free race, very laborious and frugal. Here the meanest subject can acquire and enjoy property; ends never attainable where the wretched system of slavery is established."

da Sol. Near this, to the eastward, is the outlet of *Ribeiro Bravo*, and over it the chestnut-shaded village of *Campanario*. The *Ponta da Sol*, in a westerly gale and stormy weather, appears surrounded by the colours of the rainbow; hence, probably, its name has been derived. This cape is about $3\frac{1}{2}$ leagues to the westward of Funchal.

ON THE NORTH COAST of Madeira, the *Penha d'Águia*, or *Eagle's Rock*, is a vast insulated and somewhat cube-shaped mass or mountain of rock, which rises immediately from the sea, and stands out black and huge against it. Its height is estimated at not much less than 1000 feet. The summit is an extensive surface, cultivated, and shelving toward the sea.

The pretty little town of *Ponta del Gada* is the most considerable town on the north coast, and one of the liveliest and neatest in the island. It is built on a low and richly cultivated point of land, jutting out from the base of the mountain. The houses, which are numerous, and many of them large and respectable, are scattered thickly among the vines and orchards, and with very pleasing effect. The church, large and handsome, is close to the sea.

Although MADEIRA is so elevated, excepting the eastern end, which is a low rugged point, yet it is often so entirely clouded over as not to be visible at the distance of 5 leagues. But, when abreast of Porto Santo, the island commonly appears as one great mountain, with its summit hidden in the clouds. Shortly after appear the Desertas. Having passed those islands, you will soon perceive the ships in the Road of Funchal; and, from their riding, it will be seen how the wind is in the road, as it is common to have a strong breeze from the N.E. or East, on passing the Desertas, when, at the same time, the wind, in the road, is from the S.W. or W.S.W.

When sailing in toward *Funchal Road*, a large rock, named the Loo Rock, with a fort on it, will be seen on the West side of the road, a little to the westward of the town. With this rock, N. by E., when in 38 or 36 fathoms, let go the larboard-anchor, with two cables on it; for, should there be a fresh breeze from the eastward, it will be scarcely possible to bring up until the splice is veered a good way out. It is requisite to ride in the road with a whole cable, and with a splice so situated that you may be able to cut near it, should circumstances unfortunately compel you to put to sea without weighing anchor. While riding, keep a slip-buoy on the cable, have a kedge-anchor and a nine-inch hawser to the westward, to keep the ship steady, with the hawser on the starboard bow, as the wind generally veers from the eastward to S.W. and West. When the land-wind makes a cross, the end of the hawser may be shifted.

The general anchorage is in from 30 to 35 fathoms, with the citadel (called the *Peak Castle*, a brown square fort on a hill over the N.W. part of the town) a little open to the eastward of the Loo Rock; the latter at the distance of half a mile.

With the Loo Rock and citadel in one, bearing nearly N.N.E. $\frac{1}{4}$ E. and Funchal Steeple N.E. $\frac{1}{4}$ N., the anchorage appears equally good, in 35 fathoms, stiff ground. With the same marks, with the Loo about a mile off, there is good ground in 45 fathoms. To the westward, the ground changes to sand and rock, and to the eastward it has a sudden declivity from 50 to 55 fathoms, stiff clay ground, to 100 fathoms, rock, and then no ground.

In case of a S.W. gale, which may be frequently expected in winter, the situation with the Loo and citadel in one, or the citadel just open to the westward of the Loo, will be found most convenient. On the contrary, the citadel well open to the eastward of the Loo, is the best situation when a south-easter may be expected.

When coming into the road, with a brisk wind, sail should be reduced and secured in time, to prevent having too much way through the water, at the moment of anchoring; and ships should be brought up with their heads to seaward; for thus, in case of any accident in bringing up, sails may be had off shore, or otherwise, as required.

Mr. Finlaison, who wrote his remarks in 1821, has said, "It is generally reckoned the best anchorage for ships with the Brazen Head E. by S., Point de Cruz W. by N., Loo Castle N.E.; but I would recommend ships to anchor at a good quarter of a mile to the westward of these bearings; as I am convinced that here is better holding ground, and clear of anchors. Ships should not anchor farther to the eastward than to bring the high fort [Peak Castle] on the west end of Loo Castle. With the fort open to the eastward of Loo Castle the ground is rocky, and has in it many anchors.

"Those riding in *Funchal Roads* should be very active when they observe a swell coming
in

in from the S.W.; at this moment no time is to be lost in getting under way, for the swell indicates that a gale is certainly coming on; particularly so in the months of December and January, generally the commencement of the rainy season. Should it come on to blow very hard from the westward, the best mode is to run to leeward of the Desertas, where shelter from the wind may be found, and water perfectly smooth: thus you avoid the risk of losing sails, by heaving to windward.*

Off the valley of Funchal, there are regular land and sea breezes, particularly during the summer; the sea-breeze sets in from the south-westward some time in the forenoon; the land-breeze sets off shore about ten o'clock at night, sometimes later, even to two or three o'clock in the morning: these breezes do not extend above 3 or 4 miles off shore: but, when it blows fresh in the offing, there is generally a counter-breeze in the stream of the Valley of Funchal; unless it blows hard, when the true wind prevails also in the road.

There is generally a surf on the beach, early in the year particularly, which prevents landing in a ship's boat any where, except within (to the north-westward of) the Loo Rock, about half a mile from the town; therefore, the boats of that place are employed for goods, watering, &c. The tides rise and fall about $7\frac{1}{2}$ feet; and the current along the south side of the island seems to be always governed by the true wind in the offing. The rainy season is in January, February, and March; October is also frequently a wet month, as well as November and December.

The road is open from the West to the S.S.E. The winds blow strongest here when from S.W. to S.E. Ships anchoring in the road in winter must be guarded against the consequence of a dark gloomy appearance of the atmosphere to the southward, with a swell setting in; for it is very dangerous to remain at anchor with these prognostics.

Squalls sometimes come fresh off the land; there is one instance of a hurricane down the Valley of Funchal, blowing every ship out of the road, which was so violent, that the ships were hid from the town by the spray of the sea, although in a clear sun-shining day.

The best way for ships, however large or numerous, when bound into Funchal Road from the eastward, with the wind north-easterly, is through the passage between the Desertas and Madeira. The North-easter will carry them to the offing of the Brazen Head, the East point of the Bay of Funchal. In the night a single ship may keep over toward that bluff point, and, with her boats towing a-head, when becalmed, luff up into the stream of the land-wind, and by that means fetch the anchorage. Ships must show a light at their ensign-staff in the night, to prevent being fired at from the forts and Loo-castle. In the day, they should keep farther distant from the land than in the night, to avoid being becalmed under it, and to gain the stream of the sea-breeze. If, from over-caution, or other reasons, they fall 2 or 3 leagues to the leeward of the road, they should then keep plying up in the stream of the valley, until they gain the vein of the sea-breeze. In working in with a land-breeze, it is best to make short tacks, opposite the valley; as here both the land and sea-breezes are most regular.†

* Some of the old inhabitants affirm that there is no danger in attempting to ride out a gale from the southward, as it rarely continues long. It is said that no vessels with good ground-tackle have ever been lost by pursuing this method, and that many, in attempting to get away at the commencement of the gale, have been driven on shore.—*Voyage of the Chanticleer*, Vol. i. p. 10.

Captain Fitz-roy says, "The roadstead of Funchal is well known to be unsafe in S.W. gales; and there can be no doubt that the most prudent plan is to keep at sea while they last; but I have been told, by old traders to Madeira, that ships sometimes remain at anchor, about half a mile from the Loo Rock, and ride out S.W. gales without difficulty; the under-tow being so considerable that their cables are little strained."—Vol. ii. p. 46.

† Admiral Mackellar says, in his Journal, "Of Funchal Roads, I shall only observe, that, in running for the island, it is necessary to give the North end sufficient room; so as by nearing the land too much, you may not be becalmed, and thereby drift to leeward of the Roads, observing to open out the anchorage well before you haul in; and, if possible, drop anchor to the southward of the Loo Rock, in about 30 or 35 fathoms, nearly off the centre of the town, but frigates and smaller vessels may go close in shore, and anchor in 20 or 25 fathoms: my reason for choosing this anchorage is, that there is a truer land-wind to get under way with, and a better drift, should you bring your anchor home; which, from the steepness of the bank, and the badness of the ground, often happens.

"The usual place of landing is the steps of the Loo Rock; and, though landing here is attended with some difficulty when the sea-breeze sets in, it may generally be effected without much danger; in moderate weather the beach may be landed on, but I strongly recommend landing in the island boats. Refreshments of all kinds may be had, the prices depending much on the seasons, and the number of vessels in the Roads. In leaving Madeira, you should do it during the night, or early in the morning, as then the land-wind blows right off, and you drift to sea, without risk, giving you time thereby to stow your anchors, and clear the land before the sea-breeze sets in."

Small vessels, from North-America and the Western Islands, come in, generally, round the west end of the island; but are frequently becalmed a considerable time under the high land there. From this reason, ships, on leaving Funchal should make sail with the land-wind, and stand directly off from the road; ships bound to the southward, by taking a contrary method, having continued several days becalmed under the western part of the island.

In the winter-months, eddy-winds and squalls, proceeding from the high-land, are frequent and severe, and the ships are often forced to put to sea from the road. Several westerly and S.W. gales, with rain, then frequently prevail, and prevent regaining it for some time. At these periods, Madeira and the Desertas are often obscured in fog. The squalls have been found so sudden and violent near the Desertas and about the S.E. end of Madeira, as nearly to overset the ships in the vicinity: and many have been driven by them far to the eastward.

With a gale at S.W., and a high sea rising, off the S.W. end of Madeira, a ship, in November, 1797, bore away to find shelter under the lee of the island; the weather dark with rain. Between Madeira and the Desertas, the ship was suddenly becalmed; then followed an eddy-wind from N.E., and the sea frequently over the bowsprit and jib-boom. A dark cloud was now over head, and the ship near the land of Madeira. At this time two ships were seen 2 or 3 miles to the eastward, in clear sunshine, running before a sharp squall at S.W.

It has been said that, a southerly wind never blows hard quite home to Funchal, that the south-westers and south-easters are never expected unless in January, February, and the beginning of March; and that large ships almost always ride them out; but Captain Horsburgh has stated, that "these southerly gales sometimes blow quite home to Funchal, even in November and December: and, when they are apprehended, it is common for ships of every description to put to sea. These S.W. or S.E. gales are, in general preceded by a swell in the road, often accompanied by gloomy weather, drizzling rain, and a very unsettled breeze from the land, veering backward and forward very suddenly. Under such indications, ships generally proceed to sea:" for, should it blow strong from the southward, it would be almost impossible to clear the shore; the anchorage being so close to the land. A few years ago several vessels were driven from the anchorage, and completely wrecked on shore.

The regulations of the port of Funchal require all ships before or immediately on anchoring, to acquaint the governor of the island what they are, and their reasons for stopping there. Ships of war are not to send their boats to vessels coming into the road, until they are visited by the pratique-boat, a boat manned by persons appointed to inquire if any infectious disorder is on board. The same is to be observed respecting vessels that are departing, which are not to be boarded after the visiting officer has been to search for natives attempting to leave the island clandestinely, and for prohibited goods. English ships of war salute with thirteen guns, after an assurance of an equal return.

The boats may land on the beach in summer: but they are driven by a violent surge on the shore, which is shingly. The landing near the Loo Rock, before mentioned, is safe and easy, being defended from the surge.

It is necessary to be cautious of the shore-boats, which will come to the ship to sell fish, fruits, and vegetables, as their chief object is often the sale of the worst spirituous liquors to the seamen, and sometimes concealed goods. Fresh beef, water, and vegetables, are to be procured here for the ship's company, and are sent on board in boats belonging to the place.*

There

* Masters of vessels at Madeira will do well to agree with one of the boatmen to attend the vessel when required, during her stay, leaving the remuneration to be fixed by the consignee; they will thus avoid impositions and be served much cheaper than if they only hire a boat every now and then for a trip.

Be aware of a set of pretty-well dressed fellows, who may come off and offer a good price for any articles you may have to sell; for, if once you land the articles, you will get no cash in payment, but wine only, that generally bad, and at a high price: whereas, with the respectable merchants you may sell at a nominally high profit, if you take payment in good wine.—A. L.

The PORT REGULATIONS are as follow:—On anchoring at *Funchal Roads*, no vessel can have communication with the shore, or the shipping in port, until visited by a flag-boat from the government, or from the health office. But in case of distress, when a vessel does not intend to anchor, and

There are two other anchoring-places on the south side of the island; one is off Santa Cruz, which is exposed to the N.E. winds; the other is to the westward, where ships are commonly sent to perform quarantine. The latter is a small bay to the eastward of *Ponta da Sol*, mentioned in page 376. The beach of the Quarantine-Road, as also that of Funchal, is of blue stones and black sand.

wants to have communication with the shore, her boat, by proceeding to the *Loo Castle*, will avoid being fired at; and after examination, leave is generally given for the officer in her to go into town, and return to the ship without any embarrassment.

The master, purser, or other persons coming in the first boat from any vessel regularly visited, must land at the health office, there to undergo the customary examination; and the captain or purser should proceed immediately to the Consul's office, to report the ship: passengers are free from restraint after passing the health office.

Captains or pursers so landing, must bring with them the vessel's Register and Mediterranean Pass, and also the manifest of her cargo, as without these documents business cannot be transacted at the Consular and other offices.

No vessel lying in port, can have any communication with one that is coming in, or that has already anchored, until such new comer shall have been regularly visited.

No vessel at anchor can change her berth without licence from the government.

All boats that pass between the shipping and the shore, after sun-set, are subject to pay a pistareen and a half, for a government licence.

No seaman or soldier to leave their ships without permission in writing from the captain or commanding officer.

Any seaman or soldier found on shore after sun-set, without written leave of absence, is liable to be taken up by the government, and kept in custody until claimed and sent on board ship: which will, exclusive of his maintenance, occasion an expence of 2 dollars for each individual, to be deducted out of his wages: and even with leave, as above, any disorderly conduct is immediately taken notice of by the government, and punished accordingly.

All captains or commanding officers are requested to read the above two articles to the sailors and soldiers on board their ships, as particularly relating to them.

Captains or pursers must give notice at the consul's office, 24 hours, at least, before the time of their intended departure.

No vessel is to carry from Madeira any person or persons, excepting those that came in her, *without a regular passport*; as in case of detection in attempting to do so, the Master is liable to a fine of 100 dollars, and to 3 months' imprisonment.

In cases where the captain of a vessel shall be judicially notified not to carry away any particular person from the island, and he does receive him on board, notwithstanding such judicial warnings, he becomes liable for all the debts which such person owes.

When vessels are ready to depart, the captains must, through the consul, or their consignees, apply to the government to have its visit sent on board at the hour when they will be ready to proceed to sea.

After a vessel has been visited for the purpose of proceeding on her voyage, and circumstances require her to have communication with the shore, or the shipping in port, she cannot sail until visited a second time.

No vessel can sail after sun-set, without special licence; and in case a ship is visited for departure, and finds she is obliged to remain a night after, she must not attempt to sail till visited a second time.

As vessels are frequently fired at from *Loo Castle* for attempting to anchor at night, it is recommended to those who make the port too late in the evening, to have their colours seen, to stand off and on till daylight, when the restriction ceases; indeed, at all times it is as well to hoist the colours and merchant's signal as early as possible, for the information of the consignees on shore.

Any vessel attempting to get under way before she is visited, will be fired at from the forts, and will be obliged to pay very dearly for the powder and shot. This must also be understood in not observing any of the foregoing rules.

No commander of a vessel can leave any of his crew behind him, excepting in the hospital, without first giving security in the consul's office for their subsistence.

As the greatest attention is necessary on the part of the masters of vessels for the benefit of the concerned, it will be found much to the interest of all parties, that they by no means sleep on shore; a caution of this kind is doubly necessary in the winter.

It is necessary that captains and supercargoes should be acquainted, that in case of breakage in the measurement of corn, after allowing $2\frac{1}{2}$ per cent., the vessel must make up the deficiency at the market price in Madeira, according to the long-established regulation of the British factory.

The *Loo Castle* usually fires two guns without shot, on any vessel's breaking the Rules of the Port: if those are attended to, in general they take no more notice; if not, not only the *Loo*, but the other forts, fire with ball, till their object is obtained.

As many inconveniences arise from not observing the foregoing regulations, every commander of a vessel will find it to his interest to attend to them, as otherwise he will forfeit the protection of his consul, and find the consequences in the highest degree disagreeable.

To avoid considerable delay and expence, it is absolutely necessary to have a bill of health, endorsed by the Portuguese consul, or vice consul, of the last port of clearance.

ABSTRACT, on SAILING to and from FUNCHAL, in H.M. Ship
INVESTIGATOR: by Captain MATTHEW FLINDERS, 1801.

"Aug. 1, At noon, Porto Santo bore N. 11° W. *true*, and the rocky islands called the Desertas, from N. 65° to S. 85° W. (*true*) distant 5 leagues.* The south end of these islands lies, by our observations in latitude $32^{\circ} 24' 20''$ N., which differs less than one mile from its position in Mr. Johnston's chart of the Madeiras.

"There being little wind next morning, I went off, in one of the cutters, to the southernmost island, called *Bujio*, which was not far distant. The distance, however, proved to be more considerable than was expected; and there being a current setting southward, we did not reach the shore until near three in the afternoon, when it was necessary to think of returning.

"A small ledge of rocks, which projected a little from under the cliffs at the S.W. part of the Bujio, afforded a landing-place; but it was impossible to ascend to the top of the island: We saw no other animated beings than a few birds, something like green linnets, but which were said, at Madeira, to have been canary-birds; and the other productions were scarcely sufficient to afford amusement, even to a naturalist. The cliffs over-head showed marks of irregular stratification, and in some of the lines there was a red tinge, apparently of iron. The base underneath was black and honey-combed, as if it had been in the fire, resembling, in this respect, the common stone at Funchal.

"We left the Bujio well satisfied that, so far as we could judge of the islands, the name Desertas, or Desert-Islands, was well chosen; and, soon after dusk, reached the ship. There was then a good breeze from the North-eastward, with which we steered for Madeira, tacking occasionally during the night, to take advantage of the different flaws of wind. At the following noon the ship was under Brazen-Head, which forms the east side of Funchal Road; and being there becalmed,† we towed in with the boats, and came to an anchor at four o'clock, in 22 fathoms, steadying with a kedge to the N.W. In this situation, which seems to be as good as any in the road, the bearings (by compass) were as follow:—Brazen-Head, S. 71° E.; Punta de Cruz, on the western side, N. 85° W.; and Loo-Fort, distant one-third of a mile, N. 12° W.

"The north-east winds usually prevail at Madeira in the summer-season, and sometimes blow very strong. To reach Funchal Road, ships are accustomed to sail, between the East end of the Madeira and the Desertas, before the wind. They are not very desirous of passing close to Brazen-Head, where they would be becalmed, but keep off a mile or two, in the skirt of the north-east wind, until they are off the town, or even off Punta de Cruz, where they generally find a breeze from the S.W., which takes them to the anchorage. This S.W. wind is the sea breeze of Funchal; and, during the time we lay in the road, it usually set in at eight or nine o'clock in the morning, and prevailed as far as three or four miles in the offing till sunset. A variable breeze comes off the land in the night, at which time it is recommended to ships to pass close to Brazen-Head, and tow into the road.

"On the 6th, in the evening, the scientific gentlemen returned from an expedition toward the *Pico Ruivo*, which is the highest of a ridge of mountains occupying the central parts of the island, and is said to be 5067 feet, or nearly an English mile, above the level of the sea.‡ The ascent was found to be very difficult; and this, with the heat of the weather, and limitation of their time to this evening, disabled them from reaching the summit. It was late when they arrived at the shore; and, in embarking, abreast of the town, they had the misfortune to be swamped, and to lose the greater part of their collections and sketches, although the boat was managed by Portuguese watermen, accustomed to the place.

"The best landing is behind the Loo-Rock; but the stony beach, in front of the town,

* Captain Flinders says *three* leagues, but this appears to be incorrect.

† A common occurrence when entering this way, as shown in page 378.—Ed.

‡ Under the orders of Captain Charles Wilkes, commander of the United States exploring squadron, in 1838, a party of officers made an excursion to the summit of the Pico Ruivo, when, from barometrical observations, with excellent instruments, the highest point of the peak above the consul's garden was estimated at 6181 feet. The cistern of the barometer at the garden, above the sea at half tide, was 56.6 feet. Total, 6237 feet. According to the same officers, the longitude of the consulate at Funchal is $16^{\circ} 54' 11''$, in latitude $32^{\circ} 38' 11''$. (See page 35.)

is usually safe in the summer-time. It was so on our first arrival, until the strong eastern winds, in the offing, raised so much swell as to make it dangerous, even for people experienced in the management of a boat in the surf.

"The town of Funchal is placed at the foot of a mountain, which projects from the great central ridge: and the houses, being mostly white, they form a strong, but agreeable contrast with the back land. At different elevations, up the side of the mountain, are scattered the country-houses of the richer inhabitants, placed among groupes of trees, and surrounded with vines. These, with a convent dedicated to *Our Lady of the Mountain*, which, like the houses, is white, but partly hidden by foliage, give the whole a picturesque and pleasing appearance from the ships in the road. The town is larger, and there was more trade and activity in it than I was prepared to expect in a small colony, where the students of the college, and ecclesiastics of different orders, form no inconsiderable part of the superior class of inhabitants. Several British merchants reside at Madeira; their houses of business are at Funchal, but their favourite residences are upon the side of the mountain.

"Wine, water, and fresh beef, were the supplies procured at Madeira. Fruit and onions were in abundance, and, probably, were not of less advantage to the health of the people than the more expensive articles.

"On quitting Funchal Road, (August 7,) we were taken aback, at two o'clock, by the E.N.E. wind, about two miles off Brazen Head. It blew so strong as to make it necessary to clue down all the sails; and, until next morning, nothing but close-reefed topsails could be carried with safety. At noon, the log gave 162 miles from Funchal; but the cloudy weather did not admit of taking observations." For Captain Flinder's position of Funchal Road, see pages 35, 36.

5.—THE CANARIES, OR CANARY ISLANDS.

THIS groupe of islands, supposed to be known to the antients under the name of the FORTUNATE ISLANDS, were neglected by the moderns until the year 1402, when Jean de Bèthencourt, a baron of Normandy, took possession of Fortaventura and Lanzarote, for John, King of Castile. By the treaty of peace between Ferdinand, king of Castile, and Alphonso, king of Portugal, it was agreed that these islands should belong to Spain, in lieu of the settlements on the continent of Africa, ceded to Portugal.*

PRIVILEGED PORTS of the CANARIES.—By an official notification, dated 9th Feb. 1838.—"The port of *Santa Cruz*, in the island of Tenerife, was declared a custom-house port of the first class,—that is, open for commerce of every description, national and foreign; and also to have the privilege of a port of deposit of the first class. The port *Orotava*, in Tenerife, and the port of *Las Palmas*, in the island of Canary, are declared custom-house ports of the second class—open for commerce of every description, national and foreign, with the privileges of ports of deposit of the like class. The *Puerto de Lau*, (?) in the island of Palma, and the port of *Arrecife* (or *Recife*), in the island of Lanzarote, are declared custom-house ports of the third class, open for the exportation of the productions of the country of all kinds, and for any other kind of merchandize, with cockets from the custom-houses of the first and second class. The port of *Cabreria* [Cabras], in the island of Fuertaventura, the port of St. Sebastian, in the island of Gomera, and the port of Golfo, in the island of Ferro, are declared custom-house ports of the fourth class, open for the exportation of the productions of the country, of all kinds.

"Every vessel, Spanish or foreign, that may arrive in the ports of the Canary Islands in *transitu*, that is, with the sole object of taking in water or refreshments, or repairing damages, shall not be subject to any charges except fees for the health-visit, and those for the captain of the port; the captains of such vessels being allowed (if in want of money to pay for the same) to sell part of their cargo for that special purpose, the vessel being still

* ALLEGRAZZA (the northern isle) is synonymous with *joyous*, a name given it by the first conquerors of the islands, Jean de Bèthencourt and Gadife de Salle. This was the first point on which they landed. After remaining several days at Graciosa, they conceived the project of taking possession of the neighbouring isle of Lanzarote, where they were welcomed by *Guadarfia*, sovereign of the Guanches, with the same hospitality that Cortez found in the palace of Montezuma. The shepherd king, who had no other riches than his goats, became the victim of coward treachery, like the sovereign of Mexico!—*Humboldt*.

treated as in transitu, and the effects sold and purchased being subject to the duties imposed by the tariff.

“N.B. The difference between the 1st and 2d classes of ports of deposit is that the former are open to the produce (if not especially prohibited) of all countries, whilst the latter are confined to national produce exclusively.”

DESCRIPTION, &c.—The land of the Canary islands is generally high, being variegated by volcanic mountains, among which that called the Pic, or Peak, of Tenerife, is super-eminent. The inequality of height is, however, so great as to produce differences in the temperature of the different islands. For eight months in the year the summits, excepting those of Lanzarote and Fortaventura, are covered with snow; yet in the valleys, and on the shores, the cold is seldom so great as to render fires necessary. A great proportion of the surface of the islands is covered with lava, calcined stones, and ashes, formerly emitted by volcanoes, the remains of which are still visible in all the islands; and some of them, among which is the Peak of Tenerife, are not yet entirely extinguished. The number of inhabitants is computed at 200,000. The productions, exports and imports, may be found correctly described in most geographic works. The first discoverers found neither corn nor wine; though, at present, there is plenty of both.* Variation of the compass, $20\frac{1}{2}^{\circ}$ West.

Vessels may pass between the Canaries, and through their principal channels; as there is no known danger but what may be plainly discerned, excepting a sunken rock, laid down in some charts, in the southern part of the channel, between Tenerife and the Grand Canary, about 8 leagues E.S.E. of the south point of Tenerife, and 4 leagues westward of the centre of Canary.

In sailing from Funchal to Tenerife, keep well to the westward, steering S. by W. $\frac{3}{4}$ W. [*nearly South*,] in order to avoid the *Salvages*, which are very dangerous in the night.

If prevented from weathering the *Salvages* or the *Piton*, (described beneath,) by prevalent westerly and S.W. winds, common in the months of January and February, when a heavy swell may set the ship much to leeward; you may safely bear up and run to leeward of the great *Salvage*; only observing that, if the swell be very heavy, you must cautiously avoid three shoal spots, lying to the northward and eastward of that isle. Of these, the northern one is about three quarters of a mile to the northward [*N.N.W.*] of the isle, the inner one on the N.E., 250 fathoms from it, and the outer, in the same direction, one mile and one-tenth. Two others, with 3 and $3\frac{1}{2}$ fathoms, lie at about half a mile from the eastern shore.

The SALVAGES consist of an island, named *Ilha Grande*, or the *Great Salvage*, a larger islet named the *Great Piton*, and a smaller one, called the *Little Piton*, together with numerous rocks. The *Great Salvage* lies in lat. $30^{\circ} 8'$, and long. $15^{\circ} 55'$. It is of very irregular shape, and has a number of rocks about it within the distance of a mile.

The *Great Piton* lies at the distance of $8\frac{1}{4}$ miles W.S.W. $\frac{3}{4}$ W. [*S.W. by W.*] from *Ilha Grande*. This isle is $2\frac{3}{4}$ miles long, N.E. $\frac{3}{4}$ E. and S.W. $\frac{3}{4}$ W. [*N.E. by N. and S.W. by S.*] and has a hill or peak near its centre. The *Little Piton* lies at a mile from the western side of the former, and is three-quarters of a mile long, nearly in the same direction; both are comparatively narrow. These isles are seated upon, and surrounded by, one dangerous rocky bank, which extends from the western side of the *Little Isle*, half a league to the westward.

It has been said of the *Great Piton* that, in some respects, it resembles the largest Needle Rock at the West end of the Isle of Wight; and, at a great distance, looks like a sail. Its southern part appears green, its northern part barren. It may be seen 5 or 6 leagues off. The *Little Piton* is very flat, and is connected to the south point of the Greater one by a continued ledge of rocks. The whole of the eastern side of the *Great Piton* is rocky and dangerous.

The Baron Alexander von Humboldt, in his voyage of 1799, describes his passage from Corunna to Tenerife. The diffuse style of this accomplished writer prevents our giving an exact quotation, but the particulars following are worthy of notice.

Between Corunna and the 36th degree of latitude, no organic body was seen, excepting sea-swallows and a few dolphins; no sea-weeds, nor molluscæ, the oceanic insects which emit the phosphorescent light; but, on the 11th of June, the sea appeared to be covered

* For the atmospheric changes of the barometer at the Canary Islands, see the Appendix hereafter. with

with *medusæ*.* The vessel was nearly becalmed, but the molluscs were borne toward the S.E. with a rapidity four times that of the current. Their passage lasted nearly three-quarters of an hour. But few were then seen, following the crowd at a distance, as if they were tired with their journey.

Between *Madeira* and the *African coast*, light breezes and dead calms prevailed. Here, says the Baron Humboldt, we were never wearied of admiring the beauty of the nights; nothing can be compared to the transparency and serenity of an African sky. We were struck with the innumerable quantity of falling stars, which appeared at every instant. The farther progress we made toward the south, the more frequent was this phenomenon, especially near the Canaries. In warm climates, especially under the tropics, the falling stars leave a tail behind them, which remains luminous 12 or 15 seconds; at other times, they seem to burst into sparks, and they are generally lower than those in the north of Europe. We perceive them only in a serene and azure sky: they have perhaps, never been seen below a cloud.

Lanzarote was made on the 16th of June, with exactness, by chronometer. At two, p.m., the land appeared, like a cloud, at the edge of the horizon. At five it was seen distinctly, particularly a conic mountain, which towered majestically over the other summits. The current drew us toward the coast more rapidly than we wished. As we advanced, we at first discovered the island *Fortaventura*, famous for its camels; and, a short time after, saw the islet *Lobos*, in the channel which separates *Fortaventura* from *Lanzarote*. The moon illumined the volcanic summits of the latter, the flanks of which, covered with ashes, reflected a silver light. *Antares* threw out its resplendent rays near the lunar disk, which was but a few degrees above the horizon. The night was beautifully serene and cool. Though at but little distance from the west of Africa, and on the limit of the torrid zone, the thermometer rose no higher than $64\frac{1}{2}^{\circ}$. The phosphorescence of the ocean seemed to augment the mass of light diffused through the air. After midnight, great black clouds, rising behind the volcano, shrouded, at intervals, the moon, and the beautiful constellation of the scorpion. We beheld lights carried to and fro, on shore, which were probably those of fishermen preparing for their labours.

The whole western part of *Lanzarote*, of which we had a near view, bears the appearance of a country recently overturned by volcanic eruptions. Every thing is black, parched, and stripped of vegetable mould. We distinguished, with our glasses, stratified basalt in thin and steeply sloping strata.

At sun-set the ship was again under sail, but the sea was calm, a reddish vapour covered the horizon, and seemed to magnify every object. The black mountains of *Graciosa* appeared like walls of 500 or 600 feet; and their shadows, thrown over the surface of the ocean, produced a gloomy aspect. Rocks of basalt, emerged from the bosom of the ocean, appeared like ruins of some vast edifice: but the back-ground of the picture, the coasts of *Lanzarote*, presented a smiling aspect.

The vessel was now attempting to make her passage out between *Allegranza* and *Clara*; but the wind having fallen, the current drove her toward a rock, near *Clara*, on which the sea broke with violence, and which is noted in the old charts, under the name of *Infierno*, or *Hell Rock*. It is composed of a mass of lava, three or four fathoms high, and covered with scorix, resembling coke. We may presume that this rock was raised by volcanic fire, and may, heretofore, have been much higher. It is now generally called the *West Rock*.

As the fall of the wind, and the strength of the current, prevented a passage through the channel of *Allegranza*, an attempt was made to tack through between *Clara* and the *West Rock*. This proved nearly fatal, for the current set so strongly toward the rock, that the sloop no longer obeyed the helm, and she was expected to strike upon it; but, the wind having freshened a little toward the morning, the vessel, at length, succeeded in passing.

Allegranza, *Clara*, and *Graciosa*, are now visited only for the orchilla, or archil, which

* The *medusa* is a genus of mollusca; its body is gelatinous, or jelly-like, spherical, and generally flat beneath; mouth central and beneath. There are 44 species. The larger species, when touched, cause a slight tingling and redness, and are usually denominated *sea-nettles*. They are supposed to constitute the chief food of cetaceous fish. Most of them shine with great splendour in the water. M. de Humboldt says that, the *sea-nettle* class is known by its brownish yellow colour, and by its tentacles, or arms, which are longer than the body. Several were four inches in diameter: their reflection almost metallic; their changeable colours, of violet and purple, form an agreeable contrast with the azure tint of the ocean.

is found upon them, and which is valuable for its use in dying. Clara is noted for its beautiful canary-birds, and it yields pasture for goats.

LANZAROTE is very high, and its mountains may be discerned at a great distance. On approaching, it appears black, rocky, and barren, and it has many extinct volcanoes. From its northern extremity, in latitude $29^{\circ} 15'$, a barrier of precipitous cliffs rise to the height of 1500 feet, extend in a S.W. direction seven miles, and terminate in a sandy plain, where in 1825, a volcanic eruption took place, and two considerable hills were thrown up, which were burning in 1835: a stream of lava from 200 to 300 yards broad found its way to the sea in the bay. The shore along all the N.W. side to the S.W. extremity of the island is high and precipitous, with the exception of a cove, called *Janubio*, once a harbour for small vessels, but converted into a salt water lake by an eruption in the year 1765.

On the eastern side of the island the shore is much lower than the western: near the middle of it is the port of *Naős*, a small but secure harbour, formed by several rocky islets, and having two entrances, the northern with a depth of 12 and the southern of $17\frac{1}{2}$ feet at low water, with a tidal rise of 9 feet. During winter nearly all the vessels of the island resort to this place. Two bomb-proof forts, the one mounting 11 and the other 12 heavy guns, defend the respective entrances. The town of *Arecife* is situate immediately to the southward of the port: many of its houses are large, and the streets are spacious: inhabitants, about 2500. The entire population of the island is estimated at 17,500.

The greater part of the inhabitants of Arecife are engaged in the fishery on the opposite coast of Africa, which gives employment to between 400 and 500 men from this island alone, about 250 from Fuertaventura and proportionably from the other islands.

The highest land in Lanzarote is *Montaña Blanca*, 2000 feet in height above the sea, situate nearly in the centre of the island, and cultivated to the summit. The wine of this island is very superior to that of the other islands; the grapes are superior in flavour; the soil selected for their cultivation is decomposed scoræ.* Camels are used in Lanzarote, as beasts of burthen, on account of the scarcity of water.

PUERTO DE NAOS, &c. Any vessel, not drawing more than 18 feet, may enter this port at high-water, spring-tides, and lie secure from all winds and weather; although, in sailing along the coast, the shipping appears as if at anchor in an open road, the harbour being formed by a ridge of rocks, not perceivable at any distance, as most of them are under water: these break off the swell of the sea, so that the inside is as smooth as a mill-pond. As there is no other convenient place in the Canaries for cleaning or repairing large vessels, it is much frequented for that purpose, by the shipping trading to the islands.

On the west side of Arecife lies another port, called **PUERTO DE CAVALLOS**. This is also an excellent harbour, formed, like Puerto de Naos, by a ridge of rocks; but its entrance is shallow, there being no more than 12 feet of water in it, with spring-tides. A square castle, built of stone, stands upon a small island between the two harbours, and so defends them both: this island is joined to the land by a bridge, under which boats go from one port to the other; or from Puerto de Cavallos to Puerto de Naos.

At the north end of Lanzarote is a spacious channel, called **EL RIO**, which is the strait dividing this island from the uninhabited one called *Graciosa*. A ship of any burden may pass through this strait; for, if she keeps in the mid-way, between the two islands, she will have 6 or 7 fathoms of water all along.

The **RIO** is, in general, rather more than a mile wide, and forms the only safe harbour in the Canaries for large ships, but the extreme difficulty of communication with Lanzarote presents an insuperable obstacle to its being resorted to as a harbour for trade. Here basaltic cliffs rise almost perpendicularly to the height of 1500 feet, and can be climbed only by a narrow path which winds along the face of the precipice; half way up the cliff is the only spring of fresh water in the island, but rendered useless from its situation, except to a few goatherds. From the bottom of the cliff to the shore of Lanzarote is about two musket-shots distance. The ground in the space is low; and here is a salina or salt-work.

On the N.E. extremity of Lanzarote are two remarkable rocks, composed of black vitrified matter, but in shape resembling the 'Needles,' at the western extremity of the Isle of Wight.

If a smooth place to lie in, while the trade-wind blows, be required, a ship coming into

* The preceding description is chiefly that of Licut. Arlett, 1835.

this harbour from the eastward must run a good way in, and double a shallow point, which lies on the starboard hand, taking care to give it a good berth; and this is easily done by approaching no nearer than in 4 fathoms; when past it, edge toward Graciosa, and anchor in any convenient depth; for it shoalens gradually toward the shore, close to which there are 2 fathoms.

This is a commodious place, in the summer season, for careening large ships; for a man-of-war, of any nation, that happens to be at war with Spain, may come here and unload all her stores, &c. on the isle of Graciosa, and heel and scrub. Or, if two vessels chance to come in together, the one may heave down by the other; in doing which, they need not fear any opposition from the inhabitants, for there is neither castle nor habitation near this spot.

The water, however, is not so smooth here as at Puerto de Naos, especially if the trade-wind happens to blow hard from the East, which sends in a swell that makes it troublesome, if not impossible, to careen a ship properly. But the wind here does not often blow from that quarter; those winds which mostly prevail being from North and N.N.E. In mooring here, great care must be taken to have a good anchor, with a large scope of cable toward Lanzarote; for in east and south-east winds, heavy gusts or squalls come from the high land of that isle. In the winter, the wind sometimes shifts to the S.W.; then it is necessary to weigh, and run back to the eastward, round the shallow point before mentioned, until the ship be sheltered from that wind, and there anchor.*

THE LITTLE CANARIES.—The isle **ALLEGRAZNA**, the northernmost of the Canary Islands, is composed of lava and cinders, the remains of an extinct volcano. It rises to the height of 939 feet above the sea. The edge of the crater is well defined and two-thirds of a mile across; its bottom is cultivated for Barilla. The western cliffs are precipitous, and 700 feet in height. About forty persons were resident on the island in 1835, principally employed in collecting orchilla.

The only landing place is on the south side, where a cavern extends, about 500 paces, slanting from the sea, and terminates in a little sandy bay, open above. At the entrance the rocks form a natural jetty. The village is situate immediately above, and abreast is the only anchorage, half a mile from shore.

GRACIOSA and **CLARA** were seen by Baron Humboldt, as shown in page 383. Graciosa, forming the north side of the Rio of Lanzarote, is about five miles in length and two in breadth; and, as may be inferred from its appearance, it is destitute of water. Allegranza is seven miles to the northward of it.

At about eight miles to the eastward of Graciosa stands the *Roca del Este* or the East Rock, the craggy summit of an extinct volcano; the *Roca de Ouest*, or West Rock, has been already described in page 383. Many ships have been wrecked upon these islets in the night, being misled by errors in their reckoning and by the currents.

FUERTAVENTURA or **FORTAVENTURA**.—This island is divided from Lanzarote by the channel named *Canal de Bocayna*, which is six miles in breadth: the island, as shown by chart, is singularly formed and variegated; it is less mountainous than the other islands, yet both the northern and southern extremities rise to 2500 feet above the sea.

It has two ports of trade, *Cabras* on the East, and *Tarajalejo* on the S.E., but *Cabras* contains little more than 1000 inhabitants. The anchorage at the latter is indifferent, and at the landing place, a beach of shingles, still worse. The exports shipped hence consist of barilla, orchilla, corn, camels, honey, and goat skins.

Lieut. Arlett says that, although the general feature of Fuertaventura is extreme barrenness, still there are many spots of great fertility; the most conspicuous of these is the valley of *Oliva*, toward the north end, where there is a village of the same name, the residence of the Lieut. Governor, a descendant of the Baron Béthencourt, who possesses a very considerable portion of the island. The valley of *Oliva* is about 15 miles long and generally from two to three wide. The only two streams of pure water in the island have their rise in the mountain of the *Atalaya* or watch tower; they are husbanded with great care and irrigate the whole of the valley.

* Particular plans of this Strait, and of the Harbours of Naos and Cavallos, are given in our Chart of the Azores, &c.

A paved road across the island, from Cabras to Betancuria, is the only one existing; the other ways being mere tracks following the direction of the valley, where the ground is less encumbered with stones and softer to the camel's feet. The population is from 17,000 to 18,000, scattered in small villages over every part of the island.

The interior formation of Fuertaventura is as follows: to the north is a groupe of extinct volcanoes; some of them, as *Monte Mudo*, on the N.E., rise to the height of 2160 feet; and they branch to the southward of Port Cabras, east and west to the sea, thence following the direction of the coast on each side for about 30 miles; again uniting, they encircle an extensive and arid plain and several detached villages. From the summit of the hills the course of some brackish streams may be traced by the verdure they impart. There are also some date palms, the only trees, excepting the fig, on the island.

From the southern point of junction of the mountains, one of which, *Chilegua*, on the western coast, reaches the height of 2160 feet, a narrow sandy isthmus, about five miles long and $2\frac{1}{2}$ broad, projects, connecting it with the southern extremity of the island, a peninsula, occupied by the *Monte Jandia*, a mountain which presents the most remarkable features; from the N.W. its precipitous face is seen to rise to the height of 2820 feet; and spurs or buttresses diverge from its centre to the N.E., East, and S.E., by any of which it may be ascended to a frightful ridge on the summit.

On the south side of the eastern entrance of the Bocayna, very near the N.E. shore of Fuertaventura, lies the little island of *Lobos*, or Seal's Isle, which is about one league and a half in circumference, uninhabited, and destitute of water. Near this isle is a good road for shipping; the mark for which is, to bring the east point of Lobos to bear nearly N.E. by N., and anchor half-way between it and Fuertaventura, or rather nearest to the latter. Although this road seems to be open and exposed, yet it is very safe with the trade-wind, for the water is smooth, and the ground every where clean, being a fine sandy bottom. Directly ashore from the road, on Fuertaventura, is a well of good water, of easy access.

Through the broad channel, *La Bocayna*, ships sail very safely, as it is deep in the middle, and shoalens gradually toward Lanzarote, near to which are 5 fathoms of water; but very near or close to Lobos, the ground is foul and rocky. In this passage, vessels of any burthen may find room enough to ply to windward, and there is no necessity of approaching too near to Lobos.

When a vessel comes from the eastward, with the trade-wind, and is passing through the Bocayna, to the westward, so soon as she brings a high hill on Lanzarote directly to windward of her, she will be becalmed, and soon have the wind at S.W. Should this happen, make short tacks until you obtain the trade again, or a constant northerly wind, the first puff of which will come from West, or W.N.W. So soon as this is perceived, you must not stand to the northward, otherwise you will immediately lose it again, but must steer toward Lobos; for the nearer you approach this isle, the more will you have the wind; so that, before you are two-thirds over, you will meet with a steady wind at North, or N.N.E.

When there is a great westerly swell hereabout, the sea breaks horribly on the rocks at the N.W. end of Lobos. Captain Glas affirms that, he has seen breakers there nearly 60 feet high; of which, were one to strike the strongest ship, she would be staved to pieces in a moment. "When I first saw," says Captain Glas, "those mighty breakers, our ship had just passed through the channel, between Fuertaventura and Lobos; we had a fine brisk trade-wind at N.N.E.; and, although there were no less than 10 fathoms of water, when we came into the westerly swell, yet we trembled lest the waves should have broken, and thought ourselves happy when we got out of soundings. We heard the noise of these breakers, like distant thunder, after we were past them 6 or 7 leagues."

Point Jandia or *Handia*, the south-western extremity of Fuertaventura, is a low rocky point, placed by the Chev. de Borda in lat. $28^{\circ} 4'$, long. $14^{\circ} 31'$, and by Lieut. Arlett in $28^{\circ} 5'$, and $14^{\circ} 32'$. A rock lies at half a mile from it to the S.W.

CANARIA, or GRAND CANARY.—The Isleta, or N.E. point of this island, lies 16 leagues N.W. by W. $\frac{1}{4}$ W. [*W. by N.*] from Point Handia, the S.W. end of Fuertaventura; and, in clear weather, either of these islands may be seen from the other. The centre of Canaria is exceedingly high, and full of lofty mountains, which tower so far above the clouds, as to stop the current of the north-east wind that generally prevails here; so that, when this wind blows hard on the north side of the mountains, it is either quite calm on the other side, or a gentle breeze blows upon it from the S.W.* This island is the granary of

* A description of these calms is subjoined to the present section.

the Canarian Archipelago, and has, in some districts, two wheat-harvests in the year, one in February, the other in June.

On the north-east end of Canaria is the peninsula called the *Isleta*, two or three leagues in circumference; the isthmus, by which it is connected with the main island, is low and sandy, about two miles long, and a quarter of a mile broad at the narrowest part. On each side of this isthmus is a bay, which, being exposed on the N.W. side to the swell of the sea, is, therefore, an unfit road for shipping; but small barks get in between a ledge of rocks and the shore, and lie there smooth and secure from all winds and weather. Here the natives repair their small vessels.

On the other side of the isthmus is a spacious sandy bay, called by some, *Puerto de Luz*, and by others, *Puerto de las Isletas*, from some steep rocks, or islets, at the entrance of the bay, toward the N.E. This is a good road for shipping of any burthen, with all winds, except from S.E., to which it is exposed; but that wind, which is not common here, seldom blows so hard as to endanger a ship.

The landing-place is in the very bight or bottom of the bay, where the water is generally so smooth, that a boat may lie broadside to the shore without danger. Thence, along shore, about a league to the southward, is the city of *PALMAS*, the capital of the island. Shipping, that discharge their cargoes at Palmas, generally anchor, in good weather, within half a mile of the town, for the quicker dispatch; but that place is not a good road.

The next port of any consequence in Canaria is *Gando*, situated in the middle of the east side of the island. It is a good place for shipping with all winds, except from the southward; and there good water, with other refreshments, may be had.*

LAS PALMAS is a large handsome town, containing 18,000 inhabitants: it has a cathedral, hospital, and college, with convents of different orders. It is well supplied with water, having fountains in all the principal streets; and its market, likewise, is well supplied. The city appears to great advantage from the sea, the streets rising regularly above each other, which gives it a very commanding aspect. It extends, at least, a mile in length. There is another large town, with a lofty church, about 4 or 5 miles to the southward, which stands considerably higher and more inland than Palmas. From the number of houses seen, while sailing along the island, it has the appearance of a considerable population, and of being well cultivated.

CANARY affords more anchorages than any of the other islands: the bank almost every where extending farther. During summer there is here a constant N.E. wind; the land, obstructing its course, causes the calms which prevail off the S.W. shore to the distance of 8 or 9 miles, when the aerial currents again unite. Within this space a westerly current runs close in shore, which is advantageous to the coasters.

El Cumbre, or the summit of the highest peak of Canary, has been stated by Lieut. Arlett to be 6648 feet above the level of the sea. The mountain *Sancillo*, near the centre of the island, which has a large wooden cross on its summit, 6070 feet.

TENERIFE, or TENERIFFE.—Point Naga, the N.E. end of Tenerife, bears N.W. $\frac{3}{4}$ N. [*N.W. by W.*] $15\frac{1}{2}$ leagues from the N.E. point of Canaria; but, from the western part of Canaria to the nearest part of Tenerife, the distance is 10 leagues. In the centre of the island is the famous peak, called, by the antient and present inhabitants, the *Peak of Teyde*.

The Bay or Roadstead of *SANTA CRUZ*, on the N.E. coast, is the most frequented of any in the Canaries.

On coming toward the island, in clear weather, the peak may be clearly discerned at a great distance;† it first appears like a thin blue vapour or smoke, very little darker than the

* The pilots of Tenerife assert that a rock, with only 12 feet of water over it, lies W.N.W. $2\frac{1}{2}$ leagues from Point Aldea, the western point of the Grand Canary, and that the sea breaks on it in rough weather. Its precise situation appears to be unknown.

† They say, in the Canaries, that the Peak, in very clear weather, is seen from *La Bocayna*, or the channel between the Isles of *Lanzarote* and *Fortaventura*, at the distance of about 50 leagues.

“The Peak of Tenerife is probably the most striking monument of nature in the world; for though the *Chimborazo* (in South America) soars to the height of 22,000, and the *Himalayan Dewalgi* (in Asia) to the astonishing height of 27,000, while Tenerife is but 12,176, yet the latter, by its arising directly

the sky ; at a farther distance the shade disappears, and is not distinguishable from the azure of the firmament. Before you lose sight of this towering mountain, it seems at a considerable height above the horizon, although, by its distance, and the spherical figure of the earth, all the rest of the island, the upper part of which is exceedingly high, is sunk beneath the horizon. But, in general, in sailing toward Tenerife, when the trade-wind blows, the island appears as a haziness of the sky, or as a cloud, till within the distance of 5 or 6 leagues, and then the headlands show like land, and are first conspicuous.

TENERIFE presents to the curious eye the most singular object, perhaps, in the northern hemisphere. The island appears, on sailing along the coast, from north to south, to have once been a complete cinder ; and presents to view a great deal of the brokenness and irregularity of half consumed coke. This resemblance, however, contrary to expectation, becomes less perfect as we approach the peak, the great chimney of the fiery cauldrons boiling beneath.

The Baron Humboldt's ascent of the peak is given in the Nautical Magazine, No. 47, Jan. 1836 ; and it is there stated that the volcano has not been active at the summit for thousands of years, its eruptions having been from the sides ; the depth of the crater being only about 120 feet. The Peak forms a pyramidal mass, having a circumference at the base of more than 57,105 fathoms, and a height of 12,176 feet, or rather more than two geographic miles. Two-thirds of the mass are covered with vegetation, the remaining part being sterile, and occupying about ten square leagues of surface. The cone is very small, in proportion to the size of the mountain, it having a height of only 537 feet. The lower part of the island is composed of basalt and other igneous rocks of antient formation, and is separated from the more recent lavas and the products of the present volcano by strata of tufa, puzzolana, and clay.

Captain Beechey, in his narrative of the voyage of the *Blossom*, observes, " As I purposed touching at Santa Cruz, we immediately hauled up for the land, and it was a fortunate circumstance that we did so ; for so strong a current set to the southward during the night, that, had we trusted to our reckoning the port would have been passed, and there would have been much difficulty in regaining it. I mention the circumstance, with a view of bringing into notice the great southerly set that usually attends the passage of ships from Cape Finisterre southward. From this cape to Point Naga our error in that direction, or more correctly S. 33° W. (*true*), was not less than 90 miles.

At a short distance from Point Naga, the N.E. point of Tenerife, are some high perpendicular rocks ; and 4 or 5 leagues thence, on the east side of the island, is the bay or roadstead, of SANTA CRUZ.* The best road for shipping here is between the middle of the town and a fort, or castle, about a mile to the northward of it. In all that space, ships anchor, from a cable's length distance from the shore, in 6, 7, and 8, fathoms of water, to half a mile, in 25 or 30 fathoms. Particular care must be taken, in going in, not to bring any part of the town to the northward of West, lest calms should be occasioned by the

directly from the level of the sea, is seen more conspicuously, and stands at a more magnificent elevation. The view from the summit, which it requires a whole day to ascend, is unspeakably grand. On the top of this vast pyramid of basalt is a crater forty yards deep, from which vapour continually ascends, and specimens of finely-crystallized sulphur are gathered round its lips. From this summit, when the sky is unobscured, the whole island is seen like a model. Rising around it, at a distance, are seen the Canaries, glittering on the horizon, their peaks and pinnacles coloured by every change of day. At favourable times Madeira and the African Coast are visible."—*Captain Alexander, 1837.*

Baron Humboldt says, " It may be admitted, in general, that the Peak of Tenerife is seldom seen at a great distance in the warm and dry months of July and August ; and that, on the contrary, it is seen at very extraordinary distances in the months of January and February, when the sky is slightly covered, and immediately after a heavy rain, or a few hours before it falls."

* QUARANTINE REGULATIONS, 20th Nov. 1832.—On the appearance of a British ship, a boat with a pilot, and carrying the Royal Spanish flag, will leave the mole, and point out the Quarantine anchorage. If from circumstances it should be necessary to anchor before communication can be had with the boat, the line of quarantine anchorage is S.E. and N.W. by compass, with the mole-head, (nothing to the north of it) : distance from two to six cables' length from the land ; the depth of water 10 to 20 fathoms, rocky. Anchorage to the north of the line stated is for vessels admitted to free pratique. No ship is to lower boats or communicate in any manner whatever until visited by the health-boat, and permission obtained. Ships bound to any port in any of the Canary Islands, from infected countries, must come to this bay, which is exclusively appointed for the observance of quarantine.—*Santa Cruz, Tenerife, 20th Nov. 1832.*

high land under the Peak ; otherwise you will be in danger of driving upon the shore ; and, when ashore, will have no ground on the opposite side of the ship, with 200 fathoms of line, so that anchors and cables are of no use.

When a ship lies any time in the road, it is necessary to buoy her cables, otherwise the ground, being in some places foul, may chafe and spoil them. Here vessels, if moored with good cables and anchors, may lie securely in all winds, although the bay is exposed and open to those which blow from the N.E., East, and S.E. ; however, it is not above once in the space of four or five years that they blow so hard as to cause any considerable damage. The surf frequently beats on shore, with great violence, for several days together ; and the pier is ill-contrived for shelter.*

Captain Vancouver anchored here, in 1791, and, in relation of his voyage, has stated, "We had the mortification, this morning, (May 1st,) of finding the small bower cable cut through nearly in the middle, which seemed to have been occasioned by an anchor lying at the bottom. The loss of an anchor, where no other could be procured, was a matter of serious concern ; no pains were spared to regain it until the afternoon of the 5th, when all our exertions proved ineffectual ; and, being apprehensive that other lost anchors might be in the vicinity, we weighed, went farther out, and again anchored, in 30 fathoms, on a soft, dark, oazy, bottom, intermixed with small white shells, having the northernmost church-steeple in a line with the centre of the jetty, bearing (by compass) N. 48° W., and the southernmost fort S. 71° W., about three-quarters of a mile from the town. This anchorage appeared to be so far preferable to our former situation, being nearly as convenient to the landing-place, without the hazard of damaging the cables by anchors which small vessels might have lost nearer in-shore ; and which is the only danger to be apprehended here, as the bottom is good holding-ground, and, to all appearance, perfectly free from rocks."

Captain Vancouver has observed, that, when he was here, he found the wine, water, and beef, exceedingly good, and was therefore induced to take some days' supply of the latter to sea ; but fruit, vegetables, poultry, and all kinds of live-stock, were very indifferent, and most extravagantly expensive.

The water is easily procured when the surf is not great on the beach. A good supply of wine may, also, be readily had.

The aspect of Santa Cruz is gloomy, and the heat is commonly excessive. On a narrow and sandy beach, houses of dazzling whiteness, with flat roofs, and windows without glass, are stuck against a wall of black perpendicular rocks, stripped of vegetation. A fine mole, built of free-stone, and the public walk, planted with poplars, are the only objects which break the sameness of the landscape.

Captain Fitz-roy says, "About noon, [Jan. 6, 1832,] we approached the sun-burned, uninviting town of Santa Cruz ; lying upon a level arid space, at the foot of hills that rise slowly to a considerable height, so as to shut out the more elevated part of the island ; hardly a tree to be seen, and no appearance of cultivation ; guarded by a rocky shore, on which there is always a disagreeable, often a dangerous, surf ; it offers, indeed, little to tempt delay : but, notwithstanding this unpromising exterior, and a port so exposed that Spanish ships of war were ordered by their Government to moor there with four anchors, there is much to be found in the higher and interior parts of Tenerife which amply repays the labour of ascending to and exploring those regions." (Vol. II. p. 48.)

Captain Owen has said, Our approach by night, [toward Santa Cruz,] was past a line of fishing-boats, each of which had a fire of Canary pine at the bow and stern, which pro-

* "The BAY OF SANTA CRUZ is much exposed to all winds between E.N.E. and S.W. by W. ; and, as the easterly winds are very prevalent, there is generally a great swell setting in, although it seldom blows hard from that quarter of the compass.

"In 17½ fathoms, fine sand and blue clay, directly off the jetty, with the end thereof on with the gateway leading into the town, bearing about N.W., is a convenient berth for watering, and good ground.

"The jetty is built on a curve, to break off the swell, for the convenience of boats, being the only landing-place, where all goods are landed and shipped. Ships generally lie off the jetty in from 17 to 35 fathoms, good holding-ground. The best mark is the high square building like a light-house just over and in one with the mole or jetty head.

"Tide rises about 4 feet ; sets round the bay.—H.W. 4 h. 30 m. (?)"—*Mr. Wm. Wood, H.M.S. Tartar, 1823.*

duced a beautiful effect; and as they anchor to fish on the outer verge of the bank, they are good marks for vessels, being sure of soundings when in the same line with the fishermen's lights. Immediately on anchoring they brought their fish alongside for a market. It consisted principally of a species of horse-mackerel, caught with rod and line.

The situation of Santa Cruz appears badly chosen, as regards anchorage for ships, the communication with the shore, and obtaining water; in all which particulars the next bay, about a mile to the eastward, has great superiority. The town is small, and at a distance presents a rugged and barren appearance.

Santa Cruz is frequented by outward bound ships for the purpose of obtaining a stock of wine, which can be procured at a cheaper rate, and frequently of as good a quality, as that of Madeira. At the time of the *Chanticleer's* visit in 1828, the price of very good wine was £20. the pipe of 100 imperial gallons; this was called the "London particular;" but the best old wine was only £12. the pipe, and it, in general, cannot be distinguished from the ordinary wines of Madeira.

Admiral Krusenstern says that, of Santa Cruz the characteristics are, the general misery and profligacy of the people, the gross depravity of the female sex, and the swarms of fat monks, who stroll about the streets as soon as it is dark. These objects excite, in the mind of a stranger, the sensations of pity and disgust.

"Upon the arrival of the Russian frigates toward the Road, in 1803, Don Carlos Adam, Lieutenant of the Spanish Navy and Captain of the Port, came immediately on board, and recommended us to keep to the eastward of the road, as the best place of anchorage, where we brought-to in 36 fathoms. The ground is not so rocky here as it is in other parts of the road, nor are there so many lost anchors in the ground, which is frequently the occasion of the loss of others."

From this cause, the *Neva*, which lay more to the S.W., lost a sheet-anchor and two cables, while the *Nadeshda's* cables did not suffer in the least. It is, however, necessary to take the precaution of buoying them up with casks to keep them floating; I would recommend this situation in preference, notwithstanding the great depth of water, and will therefore give the exact situation of the ship after we had let go our other anchor to the N.E. in 24 fathoms of water. The N.E. point of the road bore N. 69° E.; the S.W. point, S. 36° W.; and the church of St. Francis, which is distinguished by a very high tower, S. $51\frac{1}{2}^{\circ}$ W. There is, indeed, this disadvantage attending the situation, that should a storm spring up at S.W., and the ship not like to ride it out in the road, it would be very difficult for her to beat out. Violent storms, however, are not common, even in winter; and, if the anchor and cable can be depended upon, it is better to remain in the road. The Spaniards, and they alone, moor with four anchors; two to the N.E. and two to the S.W., in compliance with an antient law.

The mean of the several observations, which were taken in the road, made the latitude of our anchorage to be $28^{\circ} 27' 33''$; and the longitude, by Arnold's large watch, No. 128, $16^{\circ} 12' 45''$. The true longitude, as settled by the Chev. de Borda and M. Varela, is $16^{\circ} 15' 50''$.*

ORO-

* REMARKS OF CAPTAIN LISIANKY, of the *Neva*.—"The bay of Santa Cruz is not a safe anchoring place, especially in winter; from its being open to the S.E., a quarter from which the wind sometimes blows with great violence. To this may be added, that it has, in many places, a rocky bottom, and abounds so much with lost anchors and warps, that it is necessary to buoy up the cables to prevent their chafing; we found three small casks to each of our cables to be sufficient for the purpose. We were moored S.E. and N.N.W., having Fort Christoval N. $81\frac{1}{2}^{\circ}$ W., South-Fort S. $55\frac{1}{2}^{\circ}$ W., and St. Raphael N. 5° E.; and the only damage we sustained was the loss of a warp, which we could not heave up when we unmoored.

"To come into the bay, you must sail close in-shore, after passing around the N.E. part of the island; and you should endeavour to get bottom as soon as possible; for which purpose a heavy lead with fifty fathoms of line should be in readiness. The shore here is very high, and so deceiving, that, when I thought myself four leagues from it, I afterward found, by my run, that I had been mistaken by nearly half that distance.

"During our stay here, the peak was so constantly overclouded, that we could see it distinctly only twice. The summit was then (in October) covered with snow; but this is not the case, we were informed, in the months of June and July. The latitude of our anchoring-place, according to the different meridian altitudes, appeared to be $28^{\circ} 26' 36''$ N."

In 1820 or 1821, H. M. Ship Tartar anchored in the Road of Santa Cruz, in 26 fathoms, dark sand and mud, with the S.W. point of Santa Cruz, S.W. $\frac{1}{2}$ W., the church in the middle of the town W. by N. $\frac{1}{2}$ N., and the easternmost battery N. by E. $\frac{1}{2}$ E.—At a mile and a half without the ship,

OROTAVA, &c.—The next best port to that of Santa Cruz is the port of *Orotava*, on the western side of the island, and which lies about $8\frac{1}{2}$ leagues to the south-westward of Point Naga. Here the riches and fertility of the island are chiefly to be found, for here the wine is mostly made, and shipped when the weather allows. It is a good harbour in the summer-season, or from the beginning of May to the end of October; but in winter, ships are often obliged to slip their cables, and put to sea, lest they should be surprised by a N.W. wind, which throws in a heavy sea: luckily these winds rarely happen; and, in general, give warning, so that a vessel has time to get away. Straggling rocks project about two ships' length from shore, on which the sea breaks furiously. It is commonly calm in the road, but there is almost always a long northerly swell, that causes ships to roll very much.

The anchorage is in 50 fathoms, about a mile and a half from shore, with the peak bearing S.W.; and it is proper to continue a pilot on board whilst lying here.

Orotava stands upon a gentle slope at the foot of the mountain, and is surrounded by fields of corn, gardens, and vineyards. The culture of the soil is here promoted to a very extraordinary degree, particularly in some patches so elevated and so secluded as to appear inaccessible to the husbandman. But the plain is very forbidding; and the beach is composed of naked, pointed, and cinerous or scorched, rocks.

Such, formerly, was Orotava; but the memorable hurricane, of the 7th and 8th of November, 1826, destroyed, in one night, at least one-third of the whole surface of the valley, and converted a beautiful and highly-cultivated landscape into a dreary, rocky, unproductive, wilderness. The hurricane affected, in particular, all the northern side of the island, where buildings, vineyards, orchards, and other valuable property, to a great amount, were utterly destroyed. Whole villages were swept into the sea by the irresistible violence of the flood gushing down the mountains; many lives were lost, and thousands reduced to distress. At Orotava, *La Jeune Gabrielle*, a French vessel, of 300 tons, was wrecked, and only four persons saved. At Santa Cruz part of the castle of S. Miguel was washed away, and three brigs were wrecked.

ADVICES from TENERIFE, dated the 11th of November, 1816, stated the great embarrassments foreign ships have to encounter on their arrival at that island, from want of a knowledge of the regulations to be observed. Almost all the British vessels, and particularly the East-India ships, which have had occasion to touch at the island for refreshments, have been subject to a heavy expense, and much vexatious delay, by the want of bills of health, and by other omissions. To prevent inconvenience, it is necessary to observe the directions for British vessels frequenting the island of Tenerife. The directions are as follow:—

“A bill of health is an indispensable document for a vessel's admission here, from whatever port she may arrive. The quarantine-laws are very rigorously enforced, and the want of a bill of health subjects vessels, even from England direct, to a quarantine, that is never removed without the ceremony of repeated health-visits, and payment of heavy fees. Great care must be taken not to get to leeward of the island, as it is a tedious and difficult matter to get up again, the usual and prevalent winds being between N.N.E. and E.N.E. Point Naga should be made, which is the N.E. point of the island; it is very high, and is easily to be known by two large high rocks lying close to it, which appear like ships, and may be seen seven or eight leagues off. You must then run down till you come within two or three leagues; and if bound to Port Orotava, you must steer down along the north shore, (which is very bold, and quite free from danger,) keeping two or three leagues distance; and, after running down eight or nine leagues, if you should not see the Peak, which is often clouded, you will see a large white town (Orotava) on the side of the high land, about a league inland, with two small regular-shaped green hills under it, between which you must steer directly in, and, by doing so, will raise, as it were, another town out of the sea; this is Port Orotava, for which you must steer directly in, until you meet the pratique-boat, which will be about two or three miles off; it is a low-boat, and comes with the Spanish colours set upon a staff: at any rate, you must not be afraid of running in for the land, as it is very deceiving, and you will be four or five leagues off when you do not think yourself so many miles; and in that case you will not soon get a

no bottom at 150 fathoms. Stock of all kinds was then plentiful; the bullocks large, weighing from four to seven hundred weight. Ships in want of water can always be supplied, on moderate terms, by the boats belonging to the place.

boat,

boat, for they do not come off until you approach very near. The boat, when she comes, brings a pilot, and leaves him on board : you must also bring with you your register, pass, clearances, &c. ; and you must take care not to deliver either letters or other papers (except your bill of health) to any person who may ask for them, without some document, either from your consignee or the consul.

" In running down, you must prepare your anchors and cables, and it is customary to bend your small bower cable, with which you will bring up, with only one turn round the windlass, in order that it may run out quick, as the spot where you ride (about half a league off, and to the westward of the town) is very small ; and if there be many vessels there, it is necessary that your anchor go very quick, as you bring up in from 30 to 40 fathoms of water ; but there is little or no tide, and she will bring up easily. You must give her the whole cable round the windlass ; your buoy-ropes should, therefore, be 45 fathoms long. During the summer months, from April to October, all vessels are moored in an inner harbour, or creek, with iron chains, kept by the merchants for that purpose. Vessels that fall to leeward very often lose much time by mistaking Garachico for Port Orotava, from whence it is distant four and a half leagues West. There is some similarity in the appearance of these places, Garachico having also above it a white town, inland, called Icod ; but besides, by their situation, Garachico being much nearer Point Teno, the west point of the island, these places are very easily distinguished by the above-mentioned two equally-formed round green hills. Point Naga lies in $28^{\circ} 36'$, and the Salvages lie true North from the point, distant about 28 leagues.

" The Grand Salvage is very high, and may be seen ten or twelve leagues off. Your direct course from the Grand Salvage to Port Orotava is S.W. (by compass) and distance 38 leagues ; but particular care must be taken not to fall to leeward. The Peak of Tenerife may sometimes be seen forty leagues off, but it is very often hidden by clouds. Should it happen in the winter that you arrive off Port Orotava, during a N.W. or N.N.W. gale, which rarely occurs, but throws in a very heavy sea upon the coast, and would prevent a boat going off to you, it is best to bear away for Santa Cruz, on the S.E. side of the island, after doubling Point Naga.

" Santa Cruz is the preferable place to touch at, for vessels in want of water and refreshments. All vessels, on approaching these ports, ought to hoist their colours, and show their consignee's signal ; or, when unconsigned, and only visiting the island, a Union Jack at the fore, and a white flag with a pendant over it at the main, in order that boats may be early sent off to them by their consignees, or by the consul."

PALMA.—From the western end of Tenerife to the nearest part of the Island of Palma, the distance is about 15 leagues. The summit of this island is higher than the general level of Tenerife, its peak excepted ; hence some navigators run toward it with great confidence in the night.

The chief port is that of Santa Cruz, on the east side of the island. The mark by which a stranger may find it is the following :—When he approaches the east side of the island, Palma will appear shaped exactly like a saddle. Let him steer so as to fall in a little to windward of the lowest place, or middle of the saddle, till he comes within a mile of the land ; then, running along shore to the southward, he will perceive the town close by the sea-shore, and the shipping lying in the road ; but, as the land behind the town is high and steep, one cannot discern the shipping till within a mile of them. The road is within a musket-shot of the shore, where vessels commonly ride in 15 or 20 fathoms of water, and are exposed to easterly winds ; yet, with good anchors and cables, they may remain with great safety in all winds ; for the ground is clean and good, and the great elevation of the island, with the perpendicular height of the land facing the road, repels the wind that blows upon it, though ever so strong.

When there is a great north-east swell at sea, it comes rolling into the bay, but the want of wind, and the deepness of the water, deprive it of strength or power ; so that ships, in such a case, ride here with a slack cable. These circumstances render the road of Santa Cruz, in Palma, more secure than any of those of Canaria or Tenerife ; but, in the winter, the rolling swell, which comes into the bay, breaks high upon the beach, and prevents boats from going off, or landing, for the space of three or four days together.

Santa Cruz de la Palma is a large town, but not so good and large as that of Palmas, in Canary, or the towns of Tenerife. Near the mole is a castle, or battery, mounted with a few cannon, for the defence of the shipping, &c. In the middle of the town, near the great church,

church, is a fountain, filled by a rivulet, which plentifully supplies the inhabitants with good water.

Tassacorta, the port next in consideration to that of Santa Cruz, is on the S.W. part of the island; it is exposed to westerly winds, and little frequented by any vessels excepting boats.

In all the island there is no town of any note, excepting Santa Cruz; but many villages, the chief of which are St. Andrea and Tassacorta. In the north-eastern part, inland, is a remarkable high mountain, called La Caldera, or the Cauldron, being hollow, like the Peak of Tenerife.

GOMERA.—The middle of Gomera lies W.S.W. about 5 leagues from Point Teno, of Tenerife. ST. SEBASTIAN, the principal town, is situated close by the sea-shore, in the bottom of a bay, on the eastern side, where shipping lie land-locked from all winds except the S.E. Here you may anchor at a convenient distance from the shore, in from 15 to 7 fathoms; but, as the land-wind frequently blows hard, it is necessary for a ship to moor with a large scope of cable, otherwise she will be in danger of being blown out of the bay. The sea here is generally so smooth, that boats may land on the beach without danger. On the north side of the bay is a cove, where ships of any burthen may haul close to the shore, which is a high perpendicular cliff, and there heave down, clean, or repair. When boats cannot land on the beach, on account of the surf, they put ashore on this cove, from whence there is a pathway along the cliff to the town.

The town has plenty of good water, which is drawn from wells in every part of it; and, in the winter, a large rivulet from the mountains empties itself into the port. On the south side of the mouth of this rivulet stands an old round tower; and on the top of its perpendicular cliff, on the north side of the cove, is a chapel, and a battery, with a few pieces of cannon, for the defence of the port.

To the best of my remembrance, says Capt. Glas, the land that forms the north point of the bay is the most southerly point of land, on the east side of Gomera, that can be seen from Point Teno, on Tenerife. That land, when one is to the northward of it, at about a league distant, bears a great resemblance to Rame Head, near Plymouth Sound. In going into the bay, it is necessary to stand close in with this point, for the land-wind is commonly too scanty for a ship to fetch the proper anchoring-place; from that reason it is better to come in with the sea-breeze, which generally begins to blow here about noon.

The best place for a ship to lie in here is, where a full view may be had along through the main street of the town, and at about the distance of a cable's length from the beach: it is necessary to moor as soon as possible, because of eddy winds that sometimes blow in the bay.

FERRO.—This island, the westernmost of the Canaries, has neither road nor harbour worthy of particular description. It has one church, but the town is inconsiderable. The land rises steeply from the sea, and is craggy on all sides for about a league, so as to render the ascent very difficult. It produces, however, many trees and shrubs, with better grass, herbage, and flowers, than any of the other islands, so that bees and honey abound. The wine is poor, and there are only three fountains or springs of water on the island.

DIRECTIONS *for SAILING among the* CANARY ISLANDS, *by* CAPT. GLAS.

If a ship, lying at Palma, wants to go to Lanzarote, and will not wait for a fair wind, (which, indeed, seldom blows there, especially in the summer-season,) let her stand over to the N.W. side of Tenerife, and beat up along shore until she weathers Point Naga; thence, with the wind that generally prevails in these parts, she will be able to weather Canaria, and fetch the Point of Handia, or Fortaventura, or perhaps Morro Gable, (the southern point,) whence it is easy to beat up to Pozzonegro, along the east side of the island, because the sea there is always smooth. It is not quite so easy to beat up from Pozzonegro to the Isle of Lobos; yet it may be done, without difficulty, when the weather is moderate; if the wind should happen to blow hard, she may stop in the Bay of Las Playas, until it proves more favourable.

From the Isle of Lobos she will find no difficulty in beating up to Porto de Naos, in Lanzarote. It is not advisable for those who are not perfectly well acquainted with that harbour, to attempt to conduct a ship in, because the entrances are very narrow.

It is common for ships, which come loaded from Europe to Santa Cruz, Tenerife, &c., to have part of their cargoes to unload at Port Orotava: these ships, when the trade-wind blows hard, will sometimes find it impracticable to weather Point Naga: when this is the case, bear away to the leeward point of the island, and keep near the shore, where, if you do not meet with a southerly wind, you will be carried by the current, in the space of 24 hours, from the S.W. point of the island to Point Teno, whence you may easily beat up to Port Orotava; for, when the wind blows excessively strong at Point Naga, it is moderate weather all the way from Point Teno until within 2 or 3 leagues of Point Naga. But I would not advise a ship to bear away as above directed, unless when the trade wind blows so fresh that she cannot weather Point Naga: because, in moderate weather, there is little or no wind stirring on the coast between Teno and Port Orotava.

The COAST of AFRICA, east of the Canaries, is level, and is rendered inaccessible by a heavy surf, which breaks on it continually. The Canarians, in the sea between this coast and the islands, employ a number of vessels to fish for bream and cod.

Of the CALMS of the CANARY ISLANDS. (By the same.)

It has been already noticed, in the description of the Island of Canaria, "That its mountains tower so far above the clouds, as to stop the current of the north-east wind that generally blows here; so that, when this wind blows hard on the north side of the mountains, it is either quite calm on the other side, or a gentle breeze blows upon it from the S.W. These calms and eddy-winds, occasioned by the height of the mountains above the atmosphere, extend 20 or 25 leagues beyond them to the S.W. There are calms beyond, or to leeward of, some of the rest of the islands, as well as Canaria; for those of Tenerife extend 15 leagues over the ocean, the calms of Gomera 10, and those of Palma 30. "I have," says Captain Glas, "been frequently in all the calms of the islands, excepting those of Palma; and, from my experience of them, I may venture to say, that it is extremely dangerous for small vessels, or open boats, to venture within them when the wind blows hard without. It is true, indeed, the wind raises the waves of the sea to a mountainous height: yet those waves follow each other in regular succession; for, were they to fall confusedly one against another, no ship would be able to sail on the ocean. But, in a storm, the wind driving the sea before it, each wave gives place to the one which follows: whereas, in the calms in the Canary Islands, the sea, not moving forward in the same direction with the sea without, but being as it were stagnant, or at rest, resists the waves that fall in upon it from without; and this resistance causes them to break just in the same manner as the billows break upon the sea-shore, but with less violence, on account of the different nature of the resistance. This breaking of the waves is only on the very verge of, or just entering into, the calms; for within them the water is smooth and pleasant.

"Upon first coming into the calms, the waves may be seen foaming and boiling like a pot, and breaking in all directions. When a vessel comes amongst them, she is shaken and beaten by the waves on all sides, in such a manner, that one would imagine that she could not withstand their force; however, this confusion does not last long. The best way to manage a ship entering the calm is, immediately to haul up the courses, and diligently attend the braces, to catch every puff of wind that offers, in order to impel the ship into them as soon as possible. The crew must not think it strange to be obliged to brace about the yards every two or three minutes, according as the wind veers and hauls; but, after a ship is once fairly into the calms, she will either find a dead calm and smooth water, or a pleasant and constant breeze at South or S.W., according as the wind blows without, to which this eddy-wind, as it may be called, always blows in an opposite direction."

REMARKS MADE ON SAILING FROM THE CANARY ISLANDS TO THE EQUATOR, *by Captain Lisiansky, of the Russian Navy, in 1803, and on recrossing the Line, &c. on the homeward Route, in 1806.*

"Amongst the many different things deserving the attention of navigators, the sea-currents are not the least important. I am, indeed, firmly persuaded that attention to this subject may lead to useful discoveries; and accordingly made it a rule to keep a journal of the daily difference between the ship's course by reckoning and observation.

"From the Canary Islands to the latitude of 6° N., where the variable winds took place, the motion of the sea was toward the S.W. quarter: it then took a N.E. direction as far

as $1^{\circ} 34' N.$, when we received the S.E. trade; and then again to the westward, in which it continued until we passed the equator. On calculating the variation of the current from all the above-mentioned tendencies of the sea, it appears that the Neva, in her run from Tenerife to the line, was driven by it about 60 miles to the southward, and nearly the same distance to the westward.

"After having passed the equator, (longitude $24^{\circ} 9' W.$) the S.E. trade freshened by degrees; and, as we proceeded, veered a little to the East, which was favourable to our course."

On recrossing the equator, 11th May, 1806, (longitude $16^{\circ} 18' W.$) "we had a pretty strong westerly current; but it soon changed to the S.E., and so continued until we reached $9^{\circ} N.$ It then took a direction to the S.W., and occasionally to the N.W., pushing us on as far as the tropic, at the rate of 15 miles a day. From the tropic till we had variable winds, it was constantly to the S.W., when it returned again to the S.E., and kept to that point till we made the Western Islands, where we found that, from the line, we had been borne by currents, altogether, 30 miles to the South, and 3 degrees to the West.

"Between the parallels of 21° and $36\frac{1}{2}^{\circ} N.$ we passed continually a quantity of seaweeds, which appeared like large floating-islands. These weeds were full of small fish and crabs, of which we caught a great number, chiefly from curiosity."

6.—THE SARGASSO SEA.

We have already described, in general terms, that portion of the Atlantic which bears the name of SARGASSO SEA, (see page 181,) with its general boundaries. The weed, as already noticed, was met with in large quantities by Colombo; and it is said that the old navigators, *Thevet* and *De Lery*, were fifteen days in passing through extensive fields of it, which they fell in with near the tropic of Cancer.

We cannot, at present, assign with certainty the places of its growth, nor satisfactorily account for its appearance in the situations in which it is found. Sir Hans Sloane, in his *History of Jamaica*, notices that it has been seen on the coast of Africa, and near the Cape Verde and Canary Islands, as well as on the coast of Hayti: but some of these patches, as we have shown, may have been fields detached from the central beds of the ocean. He has also shown that a portion of it is carried through the Strait of Florida, and hence it has been called *Gulf-weed*.

That it grows at the bottom of the sea, in situations not yet certainly defined, appears to be a fact; yet the assumption of its growing in the *deep* sea has been pronounced, by an intelligent writer, as one quite at variance with the known decrease of temperature at certain depths; and this creates a dilemma with which we know not how to contend, otherwise than by offering the following arguments. It is almost surprising that a regular examination has never yet been made, by which the question might have been determined, although of no consequence in actual practice.*

It seems to be generally admitted that a great proportion of the weed is brought from the Mexican Sea. Captain Livingston, in his way from New Orleans to the Strait of Florida, saw large quantities of it; and every one who has navigated the Gulf-stream has remarked the weed in it, or along its borders. Sir Philip Broke and the Baron Alexander von Humboldt say that the stream contains a great deal. Sir Philip says, "We were always surrounded with gulf-weed." Major Rennell adds, "He spoke of that part of the Gulf-stream out in the Atlantic: the others might speak of other parts."

In the notes prefixed to the second volume of the *Colombian Navigator*, 1839, (page xl.) is a description of the Andros Isles, as lately surveyed, and it is there shown that, in the great sponging district, upon the Bahama Bank, west of Andros, vast quantities of the gulf weed are produced; and this may perhaps be one of the beds from which the ocean has been supplied, as well as that in the Mexican Sea, seen by Lieut. Evans, in April 1828, as shown in page 202.†

* A description of the weed, as written by Mr. Turner, is given in the *Nautical Magazine*, June, 1822, illustrated by an engraving of a very singular fish, from its size and figure, called a *toad-fish*, and found among the weed, as well as the little but well known fish, called the *pipe-fish*.

† "On the outer passage to Vera Cruz we met, for the first time, with the sea-weed in lat. $33^{\circ} 55' N.$, long. $16^{\circ} 26' W.$, and on the homeward passage, the last piece in $43^{\circ} 51' N.$, and $43^{\circ} 20' W.$ The latter on the northern edge of the Gulf-stream."—J. Evans. (*Lt. R.N.*)

On the weed found in the ocean, we have the following remarks, by *Captain Livingston*, whose name has so frequently occurred in the preceding pages.

“Many persons suppose that the Gulf-weed (*fucus natans*) grows upon the rocks about the Bermudas, others that it originates among the Florida Reefs, and a third party that it grows upon the water, without ever adhering to any thing fixed.

“All these positions seem to me equally wide of truth. Neither on the Bermuda Rocks, nor among the Florida reefs, has a single branch of Gulf-weed ever been found growing upon the rocks; and, among all the Gulf-weed met on the ocean, no person has ever found a single tuft with roots, or that, on mature examination, could be supposed, by any person of sound judgment, to have grown on the surface of the water. On the contrary, every stalk of the weed seems to have been broken off short from something to which it firmly grew, and *all the ends* of these stalks are uniformly decayed, or dried up, from the end to a short distance.

“I am of opinion that the Gulf-weed grows in the centre of the immense eddy or whirlpool, formed by the inclination of the water to the westward, caused by the influence of the trade-winds, between the latitudes of about 6° and 22° North, and the Gulf-stream, &c. between the parallels of 22° and 34° , that it *grows on the rocks at the bottom of the ocean*, in the Sargasso or Grassy Sea, in the space comprehended between the 22d and 34th parallels of latitude, and the 26th and 58th, or 60th meridians of longitude, West of Greenwich; that the stalks decaying, or being broken off by some agitation of the sea near the roots, the tops rise to the surface of the water.

“It has been stated, as a well-known fact, that the *fucus natans* grows on the rocks along the Gulf of Paria, and on the coasts of Caraccas, &c. If this be the case, it is rather strange that it should not grow on other rocks and coasts of the West-Indies. It has also been stated that, in the whole sea of floating-bushes, *Mar do Sargasso*, not a withered plant is ever discovered. This is not true, as I have seen abundance of the *fucus natans* in a state of great decay. I note the following from my journal of the *Brilliant*, from Gibraltar toward Havanna; 8th Feb. 1819, ‘the weed much decayed:’ 9th, ‘weed passed through, a. m., much decayed:’ 10th, p. m., ‘passed through much decayed weed; I remark, that the further we run to the westward, the more decayed is the Gulf-weed:’ 13th, ‘the Gulf-weed begins to look fresher.’*

“These particulars have been given, in order to show that I have not spoken at random, but, on the contrary, actually made my remarks on the spot. Some of the weed was quite brown, and in small fragments; evidently separated into such by its state of decay. It is true that the weed soon decays when it is taken out of the water, as I have often tried the experiment. The weed is never of a verdant green colour, but seems as if blanched from having been, in some degree, hid from light: I suppose from vegetating under water.”

Let us now read what the Baron Humboldt says upon the same subject.

From the depth of about 30 fathoms, in the channel, between Clara and Allegranza, to the northward of Lanzarote, a curious species of sea-weed was brought up from the bottom of the sea: the stem of a brownish colour, and three inches long; had circular leaves, of a tender green, with lobes, and indented at the edge. The vine-leaved fucus, he adds, presents a phenomenon of great interest; fixed to a piece of madrepora, this sea-weed vegetates, at the bottom of the ocean, at the depth of 192 feet, notwithstanding which its leaves are as green as our grasses.

“Mr. Turner, who has so well made known the family of the sea-weeds, and many other celebrated botanists, think that the greater part of the *fuci* (weeds) which we gather on the surface of the ocean, and which, from the 23d to the 35th degree of latitude, and 30 of longitude, appear to the mariner like a vast inundated meadow, grow primitively at the bottom of the ocean, and float only in their ripened state, when they are torn off by the motion of the waves.

“To the north of the Cape Verde Islands we met with great masses of floating sea-

* On the 8th of February the *Brilliant* was in $24^{\circ} 17'$ N. and $65^{\circ} 1'$ W. On the 9th, in $24^{\circ} 34'$ N. and $66^{\circ} 59'$ W. On the 10th, in $24^{\circ} 51'$ N. and $68^{\circ} 39'$ W. On the 12th, in $25^{\circ} 34'$ N. and $71^{\circ} 5'$ W. On the 9th, the ship passed the meridian of Porto-Rico, and was hence proceeding toward Providence Channel, Bahama. The decayed weed, we have no doubt, had drifted from the central bed of the ocean.—ED.

weeds. They were the tropic grape, *fucus natans*, which grows on submarine rocks, between the equator and latitude 40° , both north and south. I am assured from the comparison of a great number of journals, that, in the basin of the Atlantic Ocean, there exist two banks of weeds, very different from each other. The most extensive is a little to the west of the meridian of Fayal, one of the Azores, between lat. 25° and lat. 36° . The temperature of the ocean, in these latitudes, is from 61° to 68° ; and the north winds, which sometimes reign there very tempestuously, drive floating isles of weed even to the parallels of 24 and 20 degrees. The vessels which return to Europe, either from the Rio Plata or the Cape of Good Hope, cross these banks, which the Spanish pilots consider as at an equal distance from the Antillas and Canaries. The second bank of fuci (weed) is but little known; it occupies a much smaller space between the $22d$ and $26th$ degrees of latitude, eighty leagues east of the meridian of the Bahamas. It is found on the passage from the Caycos to the Bermudas. In the latitudes just described, the fuci, far from being fixed to the bottom, float in separate masses on the surface of the water. In this state the vegetation can scarcely continue a longer time than it would do in the branch of a tree torn from its trunk; and, in order to explain how moving masses are found, for ages, in the same position, we must admit that they owe their origin to submarine rocks, which, placed at the depth of 40 or 60 fathoms, continually supply what has been carried away by the currents. *It is not the Gulf-Stream, as some mariners think, which accumulates the fucus to the south of the Azores.*

"It were to be wished that navigators would heave the lead more frequently in the latitudes covered with weeds.

"The causes that unroot these weeds at depths where it is generally thought the sea is slightly agitated, are not sufficiently known. It has been said that, if the fucus adhere to the rocks with the greatest firmness before the display of its fructification, it separates with great facility after this period, or during the season which suspends its vegetation, like that of the terrestrial plants. The fish and the molluscæ, that gnaw the stems of the sea-weeds, no doubt contribute also to detach them from their roots.

"On proceeding hence, toward the West-Indies, from the $22d$ degree of latitude, we found the surface of the sea covered with flying-fish, which threw themselves up into the air 12 , 15 , or 18 feet high, and fell down on the deck. I do not hesitate to speak of an object, of which voyagers discourse as frequently as of dolphins, sharks, sea-sickness, and the phosphorescence of the ocean. None of these objects can fail of affording interesting observations to those who make them their study.

Mr. Luccock, in his '*Notes on Brasil*,' has likewise described the *Green or Weedy Sea*. He states that it extends from 11 to 35 degrees of north latitude, and from 30 degrees of longitude to an indefinite distance westward. "Here," he says, "the ocean is covered by nodules of sea-weed, from 3 to 18 inches in diameter, somewhat resembling, in form, a cauliflower when stripped of its leaves. They float lightly on the water, in parallel lines, at a very few yards from each other, and have a yellow-brown colour, like the long stringy fibre which is sometimes seen floating in the English Channel, and which I suppose to be the natural colour of all marine plants growing deeply beneath the surface of the water. These nodules or spherules are composed of a vast number of small branches, about half an inch long, which shoot from each other at an angle of about 40 degrees; hence they multiply continually toward the superficies of the sphere; and each extreme point produces a round seed-vessel. This is little more than one-tenth part of an inch in diameter, is hollow, and contains a small reddish-brown seed, scarcely occupying one-fifth part of the husk. The leaf of the plant springs from the joints of the branches, is oblong, indented at the edges, and about an inch and a half long, a quarter of an inch broad.

"When the nodule is dexterously taken up, all the branches may be traced to one principal stalk; and this invariably shows a fracture, the part by which it has been joined to some larger stem. This fracture is frequently quite fresh, and, in large and vigorous plants, shows distinctly a woody part and a cortex. On the edges of the latter the first symptoms of decay appear. They become brown, and separate themselves from the wood. This also then assumes a darker colour, and exhibits the regular process of disorganization, just in the same manner as does a slip from a currant or gooseberry bush. In process of time, the whole of the plant assumes a darker hue; and, as it decays, floats considerably lower than it did. When kept out of the water for a few hours, it becomes harsh and brown, and acquires the peculiar smell of marine vegetables in a state of putrefaction.

"Sailors say that this weed grows in the Gulf of Mexico; that it passes round Cape Florida

Florida with the stream; and, proceeding between Bermudas and the Western Islands, settles in the eddy of that vast current which encircles the northern Atlantic. To me, however, this hypothesis appears to be inadmissible, not only because there is an evident absurdity in supposing that plants may move rapidly in a still water, which the word eddy here must signify, but because it is impossible for the floating body to move faster than the current does, and in a direction differing from the set of the water. By every observation and inquiry, which I have had an opportunity of making, no uniform current has been found to exist, capable of carrying the nodules in the direction specified, and to parts of the ocean where they are found; and no one, I think, who has considered the subject, will contend that there can be one capable of conveying them through a course of four or five thousand miles before the plants show symptoms of decay. In this case, too, the *most vigorous plants must be found on the northern verge* of this sea, and the most decayed ones toward its southern limits, which is, indeed, *directly contrary to fact*; for, in the latitude of 11° North, we meet with slips which bear evident marks of being recently torn from their parent stems, and the seed-vessels there are often unusually fresh and flourishing; while, on the northern borders, we sometimes find them perishing, and even decayed; neither of which cases could occur if the plants floated southward.

"It is more reasonable to suppose that the plants grow nearly on the spot over which they float; that those which appear on the surface of the water are only the heads, or minor branches, of others, which flourish beneath; that they are broken off by the agitation of the ocean, or some other accidental circumstance, perhaps by the buoyancy of the seed-vessels themselves, which, at a great depth, must be fully sufficient for the purpose, as it enables them to float lightly even on the surface of the water. There the plant is exposed to the sun, the seed ripens, the pod bursts, and the contents descend again to form new plants, while the old ones decay and furnish manure, according to the established economy of nature among vegetables, both terrestrial and aquatic.

"A great number of very minute barnacles are found upon the leaves and stalks. The seed-pod is usually enveloped in a sort of honey-comb work, which may be taken from it, and, when examined by a lens, resembles, in appearance, the net-work in a fly's eye. Its substance, I conjecture, is coralline. Among other inhabitants of the plant is frequently a number of small crabs, perfectly formed, and evidently young, yet vigorous and active; and, when a nodule taken fresh from the water at night, is hung up in a small cabin, it emits phosphorescent light enough to render objects visible.

"The singular arrangement of the plants, in parallel lines, is evidently owing to the wind, whose direction they always observe. Each nodule places itself under the lee of its more windward neighbour, and thus observes the law of floating bodies when exposed to a current of air. Should the wind suddenly change, as it sometimes does, a point or two, in this part of the Atlantic, and blow strong, these lines become broken, and form what are commonly called *fields of weed*. These, however, are generally small, and seldom, I suspect, remain long so disarranged.

"In the month of October I have run with a fine schooner, due North, through the N.E. trades, in the longitude of 26° , and found no weed, being perhaps to the east of it. In the month of March, on board a different vessel, we formed a diagonal line, from 26° to 44° West, across the parallels from 11 to 44 degrees, and saw a great quantity of it. In May, of another year, along the same track, there was much less observed; yet I dare not say that these dates are sufficient to point out the season of ripening, maturity, and decay, of the plant; although I have never taken up a nodule which was not full of seed-pods, and never heard of a person who had noticed one destitute of them. It is said that whales come down to the vicinity of Bermuda, at a particular season, and feed upon these plants; yet I do not recollect ever seeing an individual of that species in the weedy sea; but, on the contrary, have noticed a deficiency of fishes in general; and most, if not all of those which I have seen opened on board, appeared to live, not upon vegetable food, but their fellow-inhabitants of the waters. It is probable, however, that none but such will take a bait or approach a vessel.

7.—THE CAPE VERDE ISLANDS.

The CAPE VERDE ISLANDS derive their name from the nearest point of the Coast of Africa, and consist of the Ilha de Sal, or Salt Island; Bonavista; Mayo, or the Isle of May; St. Iago; Fuego, or Fogo; Brava; St. Nicolas; Sta. Lucia; St. Vincent; and St.

St. Antonio; besides several small islets. Of these isles the most considerable is St. Iago, the chief town of which is the seat of government. The population has been estimated at 42,000 persons. Salt is the principal article of commerce.—*For the positions of the chief points, see page 37.*

We have already shown (pages 236 and 237) the usual courses and allowances to be made in sailing to these islands; and have there noticed the fogs by which they are frequently surrounded. The estimated limits of the N.E. trade-winds, in the vicinity, may be seen in pages 97 and 98. Thus much premised, we immediately proceed to the description of the isles.*

ILHA de SAL, or SALT ISLAND.—The Isle of Sal, lies between latitude $16^{\circ} 34'$ and $16^{\circ} 51'$. The meridian of $23^{\circ} W.$, according to the late survey, passes through the middle of it. The northern part of the isle is mountainous; the southern very low and sandy. Both the eastern and western sides are irregular, and the former has an almost continued reef, along shore, from North to South.

SAL derives its name from the salt-ponds upon it, wherein the water crystallizes into a beautiful salt, the chief production of the isle; as the land is so barren as to bear no trees nor verdure, excepting a few inconsiderable shrubs.

On approaching the island from the north, it will be found, in general, that the currents are very irregular. You may, on approaching, see the high land at 14 leagues off; sometimes at a greater distance. The land makes in three hillocks, of which the northernmost is the highest. This is the *Peak of Martinez*, in the N.E., the summit of which is 1340 feet above the level of the sea.

The best roadsteads of Sal are on the western side of the island; but there are three little bays on the eastern side, and one on the south. The middle bay on the eastern side, where a ship may lie, is apparently sheltered from the N.E. by a sandy reef stretching out to the eastward, and here salt may be obtained.† The other bays on this side are open to the N.E. trade-wind, which makes a very heavy sea on the beach.

Great caution is required on approaching the south end of the island in the night, it being so low as hardly to be seen 10 miles off in the day. Keep your lead going, and approach no nearer than in 30 fathoms, unless bound into the *South Bay*, which lies between the S.E. and South points of the island.‡

The S.E. point of Sal is now called *Wreck Point*, H. M. sloop *Erne* having been wrecked near it in 1819: this is surrounded by a reef. From *South Point*, forming the west side of the bay, a dangerous sandy spit extends about one mile into the sea. If coming into the bay, between these points, after rounding *Wreck Point* in 8 or 9 fathoms, bring that point to bear E. by S. and the opposite point W. $\frac{1}{2}$ N., and anchor in 9 fathoms, sandy bottom. Here you will be sheltered from the N.E. trade, and lie in perfect safety.

* Mr. Finlaison has said that, "In leaving Tenerife for the Cape Verde Islands, you will certainly have the wind from E. by S. to N.E. as you approach the islands." He also adds that, in the passage, a current was generally found setting from S.S.W. at the rate of half a mile an hour, which is contrary to the current on the African coast.—(See page 190.)

CAPTAIN OWEN has noticed that, in 1822, H. M. S. *Leven*, in shaping a course from Tenerife for the Cape Verde Islands, steered S.W. $\frac{1}{2}$ W., being half a point more to the westward than the course should have been had the compass been uninfluenced by the local attraction of the ship, or "by what is called deviation [we say *aberration*]." The *Barracouta*, at the same time, shaped hers without regard to this deviation, which in her was full one point on the S.W.: the consequence was, that she was carried considerably to the eastward of her direct course, which prevented her reaching Sal until two days after the arrival of the *Leven*. "This is mentioned," says Captain O., "to show the probability that many of the extraordinary currents said to be found in the ocean do not exist; or rather that the discrepancies between the observations and dead-reckoning may as frequently be attributed to the unthought of deviation of the compass, as to other occult causes."

But, we are inclined to think that, in the instance cited, there must have been a *compound error*; due allowance not having been made either for current or aberration.

† *Firestone Hill*.—A promontory on the eastern coast, stands at two leagues from the North Point. At the back of this is the Salt-pond Hill, a natural curiosity, as upon this is the salt-pond, 150 feet above the level of the sea. The surface of the pond, in a circular form, is 45 feet below the top of the hill.

‡ Harkening for the noise of the surf will often give ample warning in approaching land either during a fog or by night, and ought to be attended to if heard: but no one ought to run rashly, making certain of hearing it.—A. L.

At 5 miles to the west, from the *North Point* of Sal, is *Manuel* or the *N.W. Point*. Nearly true South, $8\frac{1}{2}$ miles from the latter, is a little islet, called *Bird Isle*, near a promontory, *Lion's Head*, which is 620 feet high. At a league to the northward of Bird Isle, is a small bay, called *Palmyra Bay*, and immediately to the south-eastward of the Lion's Head, is *Mordeira Bay*, which is one of the best in the Cape Verde Islands.

MORDEIRA BAY is in a semi-circular shape, one league in extent between its outer points, *Lion's Head* and *Turtle Point*. It is a safe anchorage during the N.E. breezes. Captain Bartholomew says, that it has plenty of fish and turtle, but has no watering-place; nor could that article be procured by sinking casks in the sand.

H. M. ships *Leven* and *Barracouta* anchored in this bay in 1822, and caught a great many most delicious fish: yet the place produces little else but salt and orchilla; a few goats contrive to pick up a scanty subsistence, but eagles abound.

The principal mark for anchoring in *Mordeira Bay* is, Bird Island just shut in with the foot of Lion's Head, at a mile and a quarter from the bluff land; there are several foul spots; therefore the ground should be examined before the anchor be dropped.

From Turtle Point, the South Point of Mordeira Bay, to the South Point of Sal, the distance is one league and a half: the ground between is smooth, and has 7 fathoms over it, at half a mile from shore, which is sandy: but be careful, if you anchor, that the ground is clear. In rounding the South Point, with the spit extending from it, approach no nearer than in 10 or 8 fathoms, as the latter is steep.

The latitude of the Lion's Head, according to the late survey, is $16^{\circ} 41'$; longitude, $23^{\circ} 0' 15''$. Variation, observed on shore, $15^{\circ} 20' W$. High water, 7 h. 15 m. rise 5 feet.

Between Sal and Bonavista there is, generally, a strong current.

BONAVISTA.—The Island of Bonavista, properly *Boavista*, or *Good Sight*, has been so called from the beautiful appearance it made to the first discoverers, in the year 1450. The face of it is variegated; partly low, partly rocky and mountainous; formerly fertile, now more barren. Salt is the principal article of trade, which the inhabitants readily exchange for old clothes, biscuits, meal, and raw silk. The principal place is *ENGLISH ROAD*, on the N.W.

The town consists of only forty or fifty houses, rudely constructed and mostly of negro architecture. The colour of the inhabitants is from white to negro jet, comprehending all the intermediate shades; and they are so intermarried, slaves excepted, that they may be considered as one family. The population of Bonavista, in 1822, was said to be about 3000, of whom 300 were regular soldiers. Pigs, goats, sheep, and poultry, may be had here, but all are lean, and of inferior quality.

The eastern side of Bonavista is partly environed by a reef; and, on the N.E. are the reefs on which the Hartwell, East-Indiaman, was lost, in 1787; and on which the Resolution, Captain Cook, was nearly driven by a southerly current. Half a league nearly, from the west end is a coral reef, on which the sea breaks; and, at times, the current sets on it very rapidly.

From the south end of Sal, the N.W. point of Bonavista lies true South, or S. by W. $\frac{1}{4}$ W., by compass, distant seven leagues; and, from the same end of Sal, to clear the N.E. reefs, the course, by compass, is S.E. by S. 11 leagues, in order to allow for the current that sets to the S.W. on Bonavista: be sure to make this course, and it will bring you to the eastward of these reefs; the easternmost part of which lies in latitude $16^{\circ} 10'$.

Bonavista is of an irregular shape, but nearly octagonal, and each way three leagues in extent. Its eastern side is low, but the interior is mountainous, and a ridge of high land from N.W. to S.E. divides the island into two unequal parts. Of this inland chain *Mount Juan Fernandez* is the northern part, and the southern is called the *South Mountain*. Two miles from the N.E. end is another eminence, *Mount Ochel* or *Ochello*: at the N.W. end is the *Peak Reshee*, and in the S.W. is the *Platform Hill*, with an elevation within it, called the *Man Mountain*. *English Road*, on which the town is situate, forms a bay, 5 miles in extent from N.E. to S.W., and its northern part is protected by an islet called by the English *Small Island*. The south point of this bay is *Coral Point*; and off this point, which is foul, at the distance of half a league, is a coral reef.

Off the N.E. coast, as shown above, are the Hartwell Reefs, and three kays, called *Dutch*, *Braithwaite*, and *North, Kays*. Between these is sufficient depth of water for ships, in
case

case of necessity, and proper depths for anchorage, under the lee of the reefs; but many rocks are here scattered, with only 12 or 13 feet over them, and 4 fathoms close along them, on which, with a wind, the sea breaks very high. Of the channels between these reefs, the best lies between a ledge to the E.S.E. of Braithwaite or the Middle Kay, which is always visible, and Dutch or the South Kay. This channel is three-quarters of a mile broad, and has regular soundings, from 15 to 5 fathoms; having been tried by H.M. sloop *Bull-dog*, which often sailed in and out of it, and several times anchored under Braithwaite Kay, with that Kay N.E. by E., Dutch Kay S. $\frac{1}{2}$ W. You may moor at half a mile from Braithwaite Kay, in 6 or 7 fathoms, tolerably good ground.

Braithwaite Kay is about two miles from the shore. The passage to the north-westward, between this and North Kay, is half a mile broad, and its least water is 7 and 8 fathoms. The passage between Dutch Kay and Bonavista is narrow, but in the best water are 7 fathoms. Dutch Kay bears from Braithwaite Kay S. $\frac{1}{2}$ W. [*S. by E.*] $2\frac{1}{2}$ miles.

The *North Kay* is connected to the shore by a reef, having over it only 5 feet of water. When this Kay is in a line with the summit of Mount Ochel, or the N.E. high mountain in Bonavista, it bears about W.S.W. $\frac{1}{2}$ W.

In sailing out to the south-eastward, with the wind easterly, stand well to the southward, taking advantage of the current here setting easterly, and take care not to borrow too near the back of the reefs.*

The *Brazen Hill and Point*, (otherwise *Brazen Head*), in latitude $16^{\circ} 2'$, on the S.E. coast, is the first high land to the southward of *East-sand Head*, which is the easternmost point of Bonavista. The Head is remarkable, being very bluff and perpendicular on each side. The beach is sandy. The *South Point*, which is nearly 3 leagues more to the south-westward, is low and foul, and an islet, of the same description, lies at three-quarters of a mile to the eastward. To the westward of the point is anchorage, in what is called *Portuguese Road*, with the Platform Hill bearing about N.N.W. and nearer in shore, in from 13 and 14 to 8 and 6 fathoms. In the latter depths the landing-place will bear N.E. by N. more than a mile distant.†

NORTH and WEST COASTS. From the *North Kay*, off Mount Ochell, already described, the coast is foul to *Broyal Point*, on the north coast; and there are several reefs between the latter and the N.W. end of the island, which is called the *North Point and Reef*. Small Island, which forms the N.W. side of English Road, is 4 miles hence to the S.S.W. [*S. by W.* $\frac{1}{4}$ W.]

ENGLISH ROAD is a safe anchorage during the summer months, while you have the N.E. breezes, but there are three reefs in it, as shown on the new charts. Vessels generally haul close round Small Island, in 6 and 7 fathoms, and pass within the first reef (of 10 feet) in order to avoid the necessity of making a tack to get to the anchorage. The best mark for the latter is, the town open with the N.E. end of Small Island, and the highest part of that isle about N. by E. The Ten-feet Reef generally shows itself, but when this is not the case, a stranger will do well to stand outside, rounding it at about $1\frac{1}{2}$ or 2 miles from Small Island, approaching it no nearer than in 6 fathoms, and after once opening the town taking care not to shut it in again.

The new town is on the middle of the bay, and the second reef (*New Town Reef*), lies to the westward of it, at a short distance from the beach. The *Inner Reef* lies, in like

* A ship, the *Madeline*, bound to New South Wales, was reported to have struck and been wrecked on a reef, at about eight leagues E.N.E. from Bonavista, in April, 1835, as shown in the 'Nautical Magazine,' Feb. 1837, and 'Brasilian Navigator,' 1838. Some smart but justifiable remarks upon this report have since been given in the *Nautical*, (December 1839,) the writer of which represents the case as a matter "very nicely cooked up for the edification of seamen" and the benefit of a certain 'market.' He adds, that Captain Vidal has, by his researches in the *Ætna*, satisfactorily proved that no such danger as the *Madeline* or *Bonetta* Reefs have any existence.

These imaginary dangers have also been sought for by the American exploring squadron as shown hereafter, and the result seems to be that the *Madeline* was impelled to the S.W. by the current, and wrecked on the *Hartwell Reef* of Bonavista. The tracks of the *Ætna* and *Raven*, in search of the two reefs, are shown in a chart prefixed to the *Nautical Magazine* of December, 1839, above-mentioned.

† Mr. Finlaison says, that it is requisite to give the point under Platform Hill a good berth, as there is a reef extending from it. In the day you may see the sea breaking on it. The Mountain E.N.E. clears the danger.

manner, half a league more to the northward. The Ten-feet Reef is about 100 fathoms in length, and extends nearly East and West, at rather more than a quarter of a mile from Small Island.

Mr. Keilor has said, "We experienced, in a calm, a very large sea, breaking in every part of the bay, and were, at the same time, riding with a very short scope of cable, by reason of a strong current setting out of the bay, against the sea: this current runs so high as to frequently break on the deck."

In the rainy season, which is during the months of July, August, and September, the Island of Bonavista is subject to light airs of changeable winds, with heavy swells in the bay and roadsteads.

The tide flows, in English Road, at half-past two, on full and change days, and the sea rises 5 feet. Observe that there is no fresh water for shipping at Bonavista. There is water, but not plenty of it, near the Portuguese Road.

LETON ROCK, or JOHN LETON'S ROCK, a dangerous reef, lies, as shown in the table, page 37. This shoal has heretofore been variously represented, and described as just even with the surface of the sea, which breaks upon it with great violence. The bottom about it is rocky, and swarms with fish. Its extent from North to South is about a mile.

From the centre of the reef the North Point of Bonavista bears N.E. $\frac{1}{2}$ N. [$N. 26^{\circ} E.$] $9\frac{1}{2}$ leagues, and the South Point of the same E. by N. [$N. 64^{\circ} E.$] 7 leagues.

The lamentable wreck of the *Lady Burgess*, East-India ship, one of the outward-bound fleet of 1806, was caused by striking on the Leton Rock. This ship struck among the breakers on the Rock, at two in the morning of the 19th of April, 1806. The *Alexander*, *Sovereign*, *Lord Nelson*, and other ships, narrowly escaped. The *Lord Melville* struck three times, and slipped off the rock into 25 fathoms, at the time the *Lady Burgess* was standing directly among the breakers. It appeared, from the observations subsequently made, that the Leton Reef is composed of coral; no part above water. Captain Swinton, of the *Lady Burgess*, conjectured that the extent on which a ship would strike is not above a cable's length, and that there are no breakers on it in fine weather. To the northward it appeared to be steep-to.

This danger appears to be on the central part of an extensive bank of coral soundings, extending 4 or 5 miles to the southward, and considerably to the eastward and westward. At day-light the ship *Asia* was in 52 fathoms, coral bottom, when the breakers and wreck bore E. by N., about 4 miles distant. Other ships had soundings of 25 to 50 fathoms to the West and S.W. of the reef, at from 2 to 5 miles from the breakers. Immediately after striking, the *Lord Melville* had 25 fathoms, its head being to the eastward; shortly after, 30 fathoms. This ship hove-to, with her head easterly, until day-light, and had from 30 to 40 fathoms, all coral soundings. Others had soundings 10 or 12 miles to the southward of the reef, generally coral, sometimes intermixed with sand and shells, and not less than 20 fathoms. The mean of the observations and chronometers of the fleet, gave $15^{\circ} 49' N.$ and $23^{\circ} 14' W.$, as the situation of the reef, which is on the meridian of the Isle of Mayo: its situation, according to the late survey, is $15^{\circ} 48' N.$ and $23^{\circ} 13' W.$

ISLE OF MAYO.—This island is raised considerably above the sea, but a great part is level, excepting three inland mountains, of considerable height: but these show as hummocks, and are not conspicuous. On the S.W. side is a sandy bay, called ENGLISH ROAD, within which is the town and extensive salt-pans. The soil of this isle is generally dry and unproductive, and there is but one spring of water in the island. The coast is, however, plentifully stocked with fish, which supply, with a few vegetable productions, subsistence to the poor inhabitants.

From the S.W. end of Bonavista to the island of Mayo, the course is S.W. by S., distant 15 leagues; Mayo is about 4 leagues in length from North to South, rising most toward the middle. On approaching the island from the S.E. the appearance is very different; you may descry, in the north part, two hummocks, which appear like two islands; but, when nearer, the land is perceived by which they are connected. Southward of these is a mountain, (*Monte Mayo*), with very low ground to the south, over which two hillocks are seen.

At half a league from the middle of the north side of the island is a reef extending N.N.E. and S.S.W. three-quarters of a mile, which must be cautiously avoided.

In *English Road*, ships may anchor in 7 or 8 fathoms of water. The landing is very indifferent;

indifferent; no good water to be had; and the place is quite defenceless. The shore to the eastward of and abreast the town is steep, bluff, and rocky; but, to the westward, a low white sandy beach extends to a rounding point from which a spit of sand and coral stretches outward, at a short distance from the extremity of which there is no ground at 45 fathoms. The spit may be rounded in about 16 fathoms, and a ship should not anchor farther out than in that depth, the edge of the bank being steep. At half a mile west from the town there is anchorage in 12 fathoms, lat. according to *particular plan*, $15^{\circ} 6' 10''$, long. $23^{\circ} 15'$. By general chart, $15^{\circ} 7' 30''$ N. and $23^{\circ} 17'$ W. Variation on shore $15^{\circ} 16'$ W. 1819.*

ST. IAGO.—Ships running from Bonavista to St. Iago, and being obliged to ply to windward during the night, must be cautious how they approach Mayo, on account of the reef, before mentioned, off the north point of that island; having doubled that point, they may steer S.W. to make the land of St. Iago, and thence southward until they make the Road of Praya, the common place of anchorage.

The land of St. Iago is very high, and the eastern coast is bordered with rocks, lying very near the land, along which you may sail very safely, at the distance of two miles. The S.E. part appears as a long low point, when you are to the northward or southward of it; and, from this point *S.W. by S. true*, about 6 miles, lies the east point of Porto Praya. Between the two, and near the former, lies a bay, which so much resembles that of Port Praya, that many vessels, deceived by the likeness, have run the hazard of being lost in this dangerous place: at the bottom of it are several cocoa-nut trees, and a few houses; the land between this and the point of Port Praya is mostly perpendicular, appearing, in some places, like the *Berry Head* in Torbay; and though the Fort of Port Praya, which stands on a small cliff, is a mark by which the true bay may be distinguished from the false one, yet the surest mark is, that the north or east point of the false bay is surrounded with breakers; whereas the point of Port Praya is high, steep, and free from shoals: you must haul close round the point, and keep within a cable's length of the shore to go to the anchoring-place. It may, also, be noticed that there is now a naval signal-post on the cliff, at half a league to the northward of the entrance of Port Praya.

PORT PRAYA is a fine bay, which lies between two points, bearing from each other *W. by S.* and *E. by N. true*, about $1\frac{1}{2}$ mile. As you sail round the east point, you will soon open the forts at the bottom of the bay, to the westward of which, in a valley, are several cocoa-nut trees and a small house.

The winds, except in the tornado season, are generally in the N.E. quarter, and frequently blow fresh and squally; there are, also, frequent puffs from over the high land; therefore, as you haul into the bay, it is necessary to have the top-gallant sails furled, and to take one reef or more in the top-sails. The cliffs, from the east part of the fort, are those above described: you may easily sail within a cable's length of the east land, where you will have 7 or 8 fathoms of water, and, in many places, see the ground at that depth.

On the western side of the bay lies a small black island, called the *Isle of Quails*, or *Frenchman's Island*; it is almost even to the top, but rugged at each end, and some rocks lie off each end to about half a cable's length: there is also a rocky ledge off the north end, where the water is, in general, shallow; you will not have more than 3 fathoms of water between this and the fort; inside, or to the westward of the island, it is navigable for boats only.†

Captain

* For Captain Mudge's Remarks on the Magnetic influence of Mayo, see Note 2, page 38. The variation, as found by Capt. Fitz-roy, in 1832, was 16° W.

† ST. IAGO was visited by H.M. ship *Bustard*, in 1825, when the following remarks were written by the master, Mr. *Edw. Dunsterville*:—"This island, bearing W.N.W. $\frac{1}{2}$ W., 8 leagues, appears very high. *Mount St. Antonio*, rising out of its centre, is of a conical form, and terminates in a peak, which peak, bearing N.N.W. (by compass) leads to Port Praya Road; and, as you advance westward, you will see the East end, which is very low. As a farther guide, you will see an opening, several miles north-eastward of the harbour, on *Signal-post Hill*, which gradually slopes to the westward; also *Red Hill*, which is on the larboard side of the bay, N. by W."

"The town is situate on an eminence rather high, and perfectly white; the houses being visible from S. by E. to S.W. by W."

"In sailing into the bay, keep well to the eastward, as the ground to the westward is foul. Anchor in from 10 to 7 fathoms, with the Red Hill W. by N., outer Eastern Entrance, E.S.E. Latitude of the anchorage $14^{\circ} 53' 10''$."

"A heavy swell sets into the bay, and the prevailing winds are from N.E. to East. On the 22d of October the weather was sultry, with heavy rains. Fruit, cattle, and water, may be obtained here. The two latter not very good. The watering-place is at the back of the town, and at some distance

Captain Grant, in the relation of his voyage to New South Wales,* has stated that, after rounding the S.E. point of St. Iago, there is a small bay to the East, about 4 miles, called by the inhabitants after St. Francis. This bay, he says, may be always known, by its having, at the back of it, and nearly close down to the water's edge, a high flat-topped table land, standing between two mountains, which cannot be mistaken. Port Praya has, at the bottom of it, besides the house already mentioned, a long low valley, running inland to a considerable extent, the mountains behind which are sharp and peaked. Near the landing-place there are two remarkable forts on the east side, which you must open before you come to anchor; and, on the west side, is Quail's Island, which is readily seen as you enter. But the surest mark is that, from the S.E. end of the island of St. Iago, the shore is low and rocky in general, until you reach the bay of St. Francis: thence to Port Praya the shore is of high clayey cliffs, which round into the harbour, forming the East side of it.

"Since the commencement of the last war, two forts have been erected, one of fourteen, the other of eleven, guns. They are both inclosed with a wall, kept in good order, and white-washed, which make a pleasing appearance. There are, also, several redoubts, with guns mounted in them, but in a ruinous state. The inhabitants are chiefly black, a few officers about the governor excepted. The troops appeared to be natives of the island, black, and poorly clothed. From the height that the forts and town stand on, a tolerable defence toward the sea might be made; but, if an enemy were landed, the island would instantly fall: particularly as it has few internal resources, and even water is brought from a well in the valley at the back of the town, the only place where they get water in the dry season, which could be cut off. At the time we were here, the ground was parched up, exhibiting a barren waste, scattered with pumice-stones and other volcanic matter."

It seldom rains here, but a dry haze is very prevalent. In December and January the wind is frequently far to the eastward, veering, at times, to the northward in the same season. In settled weather, there are often regular land and sea-breezes in the bay; the sea-breeze setting in near noon, with a great surf on the shore, and ending at four or five o'clock in the afternoon. The N.E. wind sets in toward evening, and continues during the night. As there is generally some surf on the beach, boats should lie at their grappels; and the casks of water hoisted into them, after being filled at the well, and rolled down and floated through the surf. By sending a pump on shore to place in the well, ships may be sooner watered than if the water be drawn up by buckets; and some planks taken on shore will be useful to place under the casks, when rolling down either over stony uneven ground or soft sand.

For sailing into Port Praya Bay, you may borrow on the eastern point (*Ponta das Bicudas*) to 7 or 8 fathoms of water, and thence proceed north-westward, to the anchorage. It is to be noticed that the ground is foul in different parts, particularly on the western side.

The best anchorage is, to bring the flag-staff on the fort N.W. by N. [*N.W.*] about three-quarters of a mile, the body of Quail's Island West, and the point of the bay opposite Quail's Island, E. by S., in 7 and 8 fathoms. Many commanders prefer anchoring nearer the north-east side of the bay than the Isle of Quails, for the sake of more easily getting under sail, without running the risk of being carried by the currents upon the points of rocks to leeward, before the vessel has gained fresh way enough to steer clear of them: and it has been observed, that vessels may anchor any where in the bay, from 9 to 11 fathoms, good bottom, but nearer to the eastern shore than to the Isle of Quails: as the wind, except in the months of August, September, and October, generally blows from the N.E.

H.M. ship *Tartar*, Sir Geo. Collier, anchored with the best bower in 11 fathoms, nearly in a line with, or a little within, the two outer points, ground of sand and bits of coral. Quail Island then bore N.W., the flag-staff of the fort N.N.W., and East point of the bay E. $\frac{1}{2}$ S. A salute of thirteen guns was returned. Stock of all kinds was in great plenty.

distance from the beach. Small casks are the most convenient in foul weather: but otherwise you raft the casks off from the ship to the beach.

"Quail Island, though centrally situated, is too near the main land to assist any one in finding the anchorage. Do not approach it, on any point, nearer than half a mile, as the vicinity is rocky, and some rocks do not appear above the surface. Saluted the governor with thirteen guns, which were returned with an equal number, and every officer was treated with respect."

* Published by Mr. Egerton, London, 4to, 1803.

"The Bay of Praya being under the south end of St. Iago, should you be to the leeward of it, you will find it difficult in beating to windward against so strong a current as there is here. In the months of July, August, and September, the rains are frequent, and the southerly winds which then prevail, cause a great sea in the bay, with a great surf on shore. The inhabitants, in these months, are subject to dangerous fevers."

For the position, see the Table, page 38. For the tides, page 149.

To the foregoing observations, the following, by an officer of the *Argo*, 1802, may, with propriety, be added:—There are two wells, from which water is obtained; the farthest, on the west of the town, is the best, and the water good. The casks must be rolled up to the well and back again, which is the most tedious part of the business. The water is drawn from the well by buckets, sent on shore for that purpose, and a tail-block, made fast to a branch of a tree, which hangs over the well. The boats will sail on and off shore.

The sandy cove, on the east side of the bay, is an excellent place to haul the seine in; as is, also, the head of the bay. The principal fish are the mullet, grey and red, rock-fish, snappers, cavalla, and a variety of small fish.

The governor-general of the Cape Verde Islands resided, formerly, at St. Iago, an episcopal city, and the capital of the island; but foreign ships having totally abandoned the road of St. Iago, which is very bad, and of difficult access, to come to that of Praya, the governor now resides at this bay during the dry season.

To those bound from Praya Bay to Bonavista, Mr. Keilor recommends that they should endeavour to sail in the evening, as the current will be favourable: he adds, do not stand too far over toward the African shore, nor work between Mayo and St. Iago, and you will find the ship get to the eastward very fast.

REMARKS on ST. IAGO, &c., by Capt. J. W. Monteath, 1824.

Nov. 20, 1824, at 4 h. 20 m. *p. m.* Mount Ochel, on the N.E. end of Bonavista, was indistinctly seen through the haze (which generally prevails among these islands) bearing N. 80° W.; the latitude (estimated by observation at noon) 16° 10'. The longitude by chronometers, at the same time, being 22° 8' 30" W. From this position we shaped our course so as to pass well to the eastward of the island Mayo, in case there should be any westerly current.

The wind during the night continued fresh, and steady from the N.E.; the vessel making a S.S.W. $\frac{3}{4}$ W. course, (by compass,) at the average rate of 6 miles an hour. At 4 *a. m.* estimating ourselves (by the distance run) to be in the latitude of the South point of Mayo, we hauled by the wind on the larboard tack, under easy sail; at day-break bore up, under all sail, on a W. $\frac{1}{2}$ N. course. Notwithstanding our vicinity to the island, the haze prevented our seeing it until within five leagues of it; the high hill on the centre then bearing W.N.W., and the North point N.W. by compass. At nine, *a. m.*, the longitude by chronometers was observed as 22° 57' 30": the course until 11 was W. by S. $\frac{3}{4}$ S. true, distance 14 miles; at the same time English Road bore N. by W. $\frac{3}{4}$ W. true, distant 4 miles.

From the coloured appearance of the water (a dirty green) this morning, it is my opinion that an extensive bank lies at least 20 miles to the eastward of Mayo, and had I observed it previous to making sail, I would have sounded it in order to ascertain the depth of water on it; but being anxious to get into Port Praya as early as possible, I did not heave-to for that purpose.

In running from Mayo toward St. Iago, I would advise vessels to steer directly for the most southerly point of the latter island; this will carry you about 4 miles clear of the S.E. point, which is low and rocky: between it and St. Francis Bay are a number of black patches of rocks, a considerable way inland, and which, at that distance, have the appearance of low bushy trees.

The Bay of St. Francis may easily be distinguished from that of Port Praya, from the west point of the former being high, while that of the latter, Cape Tubaron, is very low and rocky; it has, also, a fort with a flagstaff, which is distinctly seen before you open the Bay of Praya; this, of itself, is a sufficient mark for the harbour.

The beach in St. Francis Bay is sandy, and has a great number of palm-trees growing close to it; there are only two houses in the bay; the one on the western, and the other on the eastern, side. The flat, as mentioned by Captain Grant, is also a very good mark for this bay.

Nov.

Nov. 21, at 3 p.m., we rounded the East point of, and anchored in, *Praya Bay*, in 5 fathoms of water, black mud and sand, the eastern point of the bay bearing E.S.E.; fort at the town N.N.W. in a line with a high peaked mountain, and Point Tubaron in a line with the south end of Quail Island, S.W. by S. It is necessary to mention that, in anchoring, you should endeavour to shut in (or nearly so) Point Tubaron with the south end of Quail Island, as outside of this line the ground is very rocky, and you may have difficulty in purchasing your anchor.

After anchoring, we pulled toward the landing-place on the N.E. side of the bay, but were informed by a sentinel that we could not land until the visit was paid, which took place in about half an hour, with the usual Portuguese formalities: we were then informed that we were at liberty to land. You are not allowed to embark after sun-set without a pass.

The Island of St. Iago is high, mountainous, and rugged; it, however, contains many extensive valleys, affording good pasture for cattle, with which it formerly abounded; and, were it in the hands of any industrious nation, would be capable of very considerable improvement; although about Praya the water (except by wells) is scarce, yet in the other parts of the island, as I was informed, it is well watered, and by irrigation, might produce sugar, maize, and vegetables, in abundance; but, from the rapaciousness of the government, the people have no encouragement to improve their condition, which, at present, is miserably poor; as they are fleeced of every thing which can, by any pretext, be laid hold of. Cotton and Indigo thrive well, the whole of the valleys and heights about the town being covered with these plants; but the people do not take any pains to cultivate them.

The town of Praya stands on a hill at the bottom of the bay, and consists of three streets extending in an East and West direction. The *Plaza* or Square is in the N.W. quarter of the town, and contains the Custom-house, Barracks, Jail, and other public buildings. All the inhabitants, fit for service, are armed with pikes, and are drilled regularly every morning in the square by the officers of the garrison. The fort, which faces the bay, mounts 40 pieces of cannon, principally 9 and 12 pounders, and which are in tolerably good order. The Magazine and Church stand on the western side of the fort. There are two other forts on the heights on the eastern side of the bay, which command the road, and would prove very serviceable in case of an attack by sea.

The landing-place for goods is on the N.W. part of the bay, from which there is a road to the town; this road is, however, very steep, and all the goods are carried up the hill by negroes, which incurs a considerable expense to the owners. The well is situated in a valley at the back of the town, and is nearly half a mile from the landing-place: it was formerly kept very dirty, but the present governor has built a shed over it: there is also a crane, with eight buckets attached, and a guard placed to prevent any improper use of it. You may land the casks and fill them with your own people, but I should prefer getting this done by the natives, as the heat is very oppressive, and the sailors are so liable to get sick, owing to the heat and the facility with which they are supplied with the spirits of the country, which are wretchedly bad. The cost of a puncheon from the boat, filling at the well, and rolling back to the beach, is three-quarters of a dollar; small casks in proportion. I was informed that the governor intended to bring the water in pipes to the beach, and charge the above price; if so, it will greatly facilitate a vessel's watering, and save the casks very much.

In January, 1830, it was officially announced that the health-visit (the charge for which was formerly six dollars) was, by a royal decree, entirely and for ever abolished; and that, in lieu thereof, it is provided that if any ship-master desire a certificate that his vessel has been admitted to entry, he shall have the same on payment of one dollar. The port-charges at Villa de Praya were, at the same time, reduced to less than ten dollars.

Fruit was, formerly, very abundant and cheap; as were cattle, goats, and pigs.* There
is

* But, in a dreadful mortality which prevailed among the cattle, in the month of March, 1828, the greater part is said to have perished.—Ed.

The Salem Register, (American paper,) in October, 1832, gave the following melancholy details of a famine at these Islands:—"By the arrival at this port of the *Fredonia*, Captain Rider, in thirty days from Port Praya, we learn that a universal famine extends through the whole groupe of these once truly verdant islands. Three years have now elapsed since they have been visited with rains in any considerable quantities. The land, in the mean time, has become parched and unfit for cultivation, and has yielded little or nothing to repay the toil of the cultivator. The season for the crops
of

is an export duty of 15 per cent. on cattle, pigs, goats, and corn; turkeys and fowls at the town are, in general, scarce, but can be procured, from the interior of the island, in two or three days; these pay no export duty. The greatest revenue arising from these islands to the crown of Portugal is obtained from the Orchilla weed, and which is monopolized by the government.

The Governor-general resides here during the dry season, but, on the approach of the rainy months, he removes to Bonavista. He is making considerable improvements at Villa de Praya, but is much hampered by want of money; the court of Lisbon sending out no returns in lieu of those sent from the islands.

The Americans of the United States have a consul here, and have considerable trade among the islands, which they supply with coarse India goods, tobacco, fish, lumber, butter, shoes, tea, and a variety of other articles, which they barter for hides, goat-skins, old copper, and camwood, which last is procured from Africa.

Through the polite attention of the British consul-general, who procured for us every thing we required, we were next day ready for sea; and to that gentleman and his lady we were much indebted during our stay for the attention and hospitality we received from them. At sun-set we got under way without difficulty, and proceeded on our voyage.

The latitude of the anchorage, by circle and sextant, was observed as $14^{\circ} 53' 57''$, and the longitude, by mean of chronometers, as $23^{\circ} 31' 15''$.—(See the Note on page 38.)

H.M.S. *Beagle* visited Port Praya, in January, 1832, and Captain Fitz-roy's Remarks on this place, as then conditioned, are as follow:—

“The wind being always from the North or East during this season of the year (December to June) a ship can moor as close to the weather shore as may be convenient; but during July, August, September, and October, no vessel should deem the Bay secure, or anchor near the shore, because southerly gales sometimes blow with great strength, and the rollers, or heavy sea sent in by them, are dangerous to ships which have bad ground tackle, or are lying near the land. As I have myself experienced the force of these gales, in the vicinity of the Cape Verde Islands, and witnessed the sea raised by them, I can confidently warn those who are inclined to be incredulous about a gale of wind being found in 15° of north latitude, beyond the limits of the hurricane regions.

Strong gusts come over the land into the Bay during the fine season, when the breeze is fresh; therefore a ship entering, with intent to anchor, ought to have a reef in her topsails, and be ready to clew up the top-gallant sails at a moment's warning.

The vicinity of Port Praya offers little that is agreeable to the eye of an ordinary visitor. A desolate and hilly country, sun-burned and stony, with but few trees even in the valleys, and those only the withering spectre-like trunks of old palms, surround the harbour. The distant and higher parts of the island, however, present a striking outline: and no person who has visited the port of Praya only can form the slightest idea of the beauty of the interior country.

Fruit was abundant; there were oranges, grapes, plantains, bananas, sour-sops, mammees, apples, guavas, quinces, sapodillas, papaw apples, pines, citrons, medlars, figs, and occasionally apples.

Notwithstanding its unfavourable exterior, its small and dirty town, and its black or brown population, I am inclined to think Port Praya of more consequence to shipping than is usually supposed. Water may be procured by rafting the casks, placing the pump in the well, and hiring a few of the natives to do the more laborious work of filling and rolling. The local authorities are attentive and obliging; it is, indeed, their interest to be so, because much of their trade, and even many of the necessities of life, depend upon the

of the present year has nearly gone by, and the seed remained in the earth without signs of coming to maturity, unless it should be speedily visited by copious rains. The trees and all kinds of vegetation are withering and passing away. Most of the animals in the islands have died from starvation, and those that remain are of no service to the inhabitants; they having strength hardly sufficient to sustain their famished bodies. It would be difficult to present to the reader an adequate idea of the horrid condition in which the inhabitants were placed when Captain Rider sailed. At every port at which he stopped the utmost misery existed among all classes.” This is a serious specimen of the vicissitudes to which the islands are subjected.

visits of shipping. Fowls, turkeys, and pigs, are very plentiful, but it is better to procure them by barter than with money. Clothes, new or old, are eagerly sought for, and their full value may be obtained in the produce of the island. The population is said to be about 30,000, a few of whom are Portuguese by birth, and many are descended from Portuguese parents, but the greater number are negroes.

"The exports were small quantities of sugar, cotton, and coffee. Hides of small bullocks, sheep, and goat skins; horses, mules, and asses, of an inferior description, are sometimes sent to the West-Indies. The Archilla weed, so much used in dyeing, is however, the staple commodity, and under proper management, might be made highly profitable. At the time of our visit the yearly revenue arising out of the government monopoly of this article amounted to 50,000 dollars; and in some years it has been as much as 300,000. This weed grows like a kind of moss upon the cliffs, and is collected by men who climb up or are let down by ropes, like the samphire gatherers. The natural dye is blue, approaching to purple; but by using metallic and other solutions it may be turned to purple, crimson, or scarlet. A kind of castor-oil plant is found, from which a small quantity of oil is obtained and a sort of soap. Yams are very scarce; but vegetables of various kinds have been abundant in their seasons.

"*From August to October* is the rainy and sickly season. In September a S.W. gale is usually experienced; but, from five to ten hours before its commencement a dark bank of clouds is seen in the southern horizon, which is a sure forerunner of the gale. Should a vessel be at anchor in the port at such a time, she ought to weigh and put to sea until the storm has ceased and the swell subsided. In the month of September preceding our visit, an American merchant brig and a Portuguese slaver were at anchor in Port Praya. A bank of clouds was seen during the day in the S.W., and the American went to sea; but the slaver remained at anchor. A storm arose at night, drove the slave vessel ashore, and dashed her to pieces in less than half an hour, yet did the American no damage whatever, and the next day she anchored again in the port.

In a valley near the town is a very remarkable tree of the baobab kind, supposed to be more than 1000 years old; but I am not aware of the grounds upon which this assertion is made. Wild guinea-fowls are found in flocks, and there are wild cats in the unfrequented parts of the island; but if induced to take a gun in pursuit of the guinea-fowls, I would advise a stranger not to overheat himself, or sleep on shore at night; for fatal fevers have been contracted by Europeans, who were unguarded as to their health, while passing a few days in this hot climate, after being for some time accustomed to the cold weather of a high northern latitude.

Except during the rainy season, the wind is always north-easterly, and then the sky is clear and the sun very powerful; but a dry haze hangs over the island in a peculiar manner, and a quantity of fine dust, quite an impalpable powder, frequently settles on every exposed surface, even on the sails and rigging of a vessel, when passing near the islands.

On the 8th of February our instruments were re-embarked, and, after swinging the ship to ascertain the amount of local attraction, we weighed anchor and sailed. By the compass, fixed upon a stanchion in front of the poop, not 20 minutes difference of bearing could be detected, in any position of the vessel: the object observed being the highest point of a sharp peak, distant 11 miles.

On the 13th a very confused swell seemed to presage a change of weather. (Lat. 4° N. long. 27° W.) Hitherto the wind had been steady from the N.E., and the sky clear; but on this day large soft clouds, light variable breezes, rain, and sometimes a short calm, showed us that we had passed the limits of the N.E. trade wind. 14th, Similar weather, with a good deal of rain, but still breeze enough to keep us moving on our course.

On the 15th the wind was steady from E.S.E., and the sky free from threatening clouds. We had then entered the S.E. trade wind, without having had two hours calm. (*Vol. ii.* 51—56.)

FUEGO or FOGO.—This island, much higher than any other of the Cape Verde Islands, is only a continued mountain, rising into a peak of great height, which burns continually. The height of this peak is $1626\frac{1}{2}$ fathoms above the level of the sea. This island has, nevertheless, some inhabitants, whom the eruptions of the volcano force sometimes to quit the island. The ground is clear within a mile of the shore, on the N.W., West, and South, parts; but, on the S.E., East, and N.E. parts it is rocky. At about 4 miles from the

the north end of Fogo lies a rock, with 12 or 14 feet of water on it, over which the sea breaks when it blows hard, but not else, and the bottom is clean all round it.*

The town is that of *Nostra Senora da Luz*, or *Luz*, on the western side. The roadstead is open, and the anchoring ground off the town very close in, being only half a mile from the shore. In 25 fathoms, rocky bottom, the northern extremity bears N. 20° E. [N. 4° W.]; the southern extremity, S. 68° E.; the northern flagstaff N. 85° E.; the southern, N. 21° E.

No other soundings are to be obtained near either Fogo or Brava with a line of 130 fathoms, at three-quarters of a mile from shore.

The marks, says Mr. Keilor, when a brig was at anchor off the town, in 10 fathoms of water, were, the town bearing E. by N., a quarter of a mile; the Mount, E.N.E.; the south end of Brava, S.E. by S. The bay is open, with foul ground, and a bad landing for boats. Corn, fruit, and cattle, may be purchased at Fogo, but water is scarce.

BRAVA.—Brava is very high, and might be seen at a great distance, were it not constantly covered by a dense atmosphere. Its climate is temperate and healthy. The winds here prevail at N.E. or East most part of the year, excepting in July, August, and September. The channel between Fogo and Brava is nine leagues in breadth. Five miles to the N.N.E. of Brava are the *Rombos* or *Romes*, two small rocky isles, nearly connected by smaller rocks, forming a crescent. The westernmost isle is lofty and has a peak on it. Between these islets and the North end of Brava is a clear passage. Brava has heretofore had plenty of corn, live-stock, and fruit; but bad landing for boats, except in the harbour on the N.E.

Although Brava is very high, its mountains rising one above the other, like pyramids; yet, being so near the isle of Fogo, it seems, in comparison, to be but low. It produces plenty of salt, and abounds most with saltpetre of any of the islands. According to Captain Roberts, it has several bays or roads, where a ship may anchor, the best of which, called *Furna*, or the *Oven*, lies toward the north-east end of the island; if you haul in near the rock, which is a very good kay, having water enough by the side for a first-rate man-of-war, you will lie land-locked from all winds; nor does any wind blow in there, except from the S. by E. to the S.W., which heaves a sea into the bay, and makes it very well deserve the name of a harbour.

The natives of Brava are all blacks, and very few; you will find them the most harmless, hospitable, and generous, of all the islanders.

St. NICOLAS.—At this island vessels of different nations have occasionally touched for refreshments; which were sold at moderate prices. The land is high, and the coasts therefore subject to heavy squalls, &c.

There are two remarkable mountains, which may be seen from a distance of 15 leagues; one in the shape of a sugar-loaf, called the *Peak of Trade*, which is near the middle of the island; the other, *Monte Gordo*, near the west end.

From English Road, in Bonavista, to the East Point of St. Nicolas, the *true* bearing is W.N.W. and the distance 22 leagues: the course must be regulated according to the set of the sea. The east end of the island may be known by its being a platform point, having a pyramidal rock, which appears like a sail, at a short distance.

On the south side, at a league and a half from this end of the island, is a bay, having a black sandy beach and a pond of fresh water, supplied from the mountains, and hence called, by the English, *Freshwater Bay*. To anchor in this bay, shut all the land to the eastward within the east point of the bay; you will then lie in 7 fathoms of water, within half a mile from the shore. There is good landing for the boats, with plenty of good water in fine weather, and at neap-tides; for, as the tides rise here 5 or 6 feet on the new and full moon, the pond is then overflowed. At this time you are subject to heavy squalls; and, notwithstanding the wind blows off shore, the sea is very high close to the beach.

At about 4 leagues to the westward from the middle of Freshwater Bay, lies *St. George's Bay*, where a ship can get refreshments; but there is no water. This bay is known by a sugar-loaf mount, and a flag-staff on the hill above the bay: there is tolerably good anchoring in 7 fathoms, close to the shore; but, without that depth, or in 9 or 10 fathoms, the ground

* Not inserted in the Admiralty chart: its existence is, therefore, questionable.

is rocky. There is a shelf stretching S.E. by S. from the N.E. point of the bay, on which less water is found than within it; so that, should your anchor start, which will happen if you are not careful, the bank being very steep, and the squalls very sudden, it may hook this shelf and be lost. The marks to anchor are, the cove, or landing-place for boats, N.W., distant a quarter of a mile; Sugar-loaf Mount N.E. by E., and the flag-staff N.W. by N.

On the S.W. side of St. Nicolas is *Terrafal Bay*, where you may anchor in from 20 to 10 fathoms, with the coast to the southward bearing S. by E. and the Islands Raza and Branco in a line bearing N.W. by W. $\frac{1}{4}$ W. [*W.N.W.* $\frac{1}{2}$ *W.*] and the landing-place E. $\frac{1}{2}$ N. a quarter of a mile.

The Custom-house is situate on the S.E. angle or corner of this bay. From this to the West point of St. Nicolas there is a bank of soundings, with from 40 to 20 and 35 fathoms at half a mile from shore. In the last depth is anchorage, in sandy ground, at a mile S. by W. from the West point, but sheltered only from the N.E.

There is, in Terrafal Bay, a high bluff rocky point, nearly a quarter of a mile short of the sea-side; in which place it is low, stony, gravelly, and, in some places, shingly, ground; the shore being a pebbly beach. On each side of this point is a very deep gully, out of which come violent flaws or gusts of wind; and, therefore, when any thing of a hard gale blows, it is very difficult to turn up into this bay. To avoid these flaws, you must anchor right against the point, between the gullies, where you may ride very easy under its lee, in from 16 to 3 fathoms.

Within this Bay the depths are 12, 13, and 14, fathoms, soft ground; and then they shoalen gradually to the shore, to the depths of 4 or 5 fathoms, where you have again sand to the pebbly beach.

By digging a well, almost any where on the low land, you may water here, unless the rainy season has failed; but there is always water in the valley, about half a mile from the sea, whence the natives will bring it down on asses for a trifle. From this road you may see, in clear weather, all the leeward islands; but, if it be in the least hazy, the Isle Raza is not discernible.

RAZA, BRANCO, and ST. LUCIA.—These islands lie between those of St. Nicolas and St. Vincent, as shown on the charts. Rugged and mountainous, they partake of the general character of the other islands. RAZA lies true West 8 miles from the West Point of St. Nicolas, and appears in the old charts under the name of *Chaon* or *Dog's Isle*. It is nearly two miles long, from East to West, and $1\frac{1}{2}$ broad. The landing-place is under the N.W. point facing the West. This island is low and uninhabited. The edge of its coast is steep and rocky, and landing is difficult when there is any wind. Between it and Branco, at about one-third from Raza, is a coral reef, extending S.S.W. and N.N.E., and having on its shallow part 6 fathoms of water, but deepening gradually on the west to 15, and on the east to 18 and 20 fathoms. The sea continually breaks over the reef, owing to a strong tide or current setting through between the isles.

BRANCO, the Redonda of the old charts, is a league to the N.W. of Raza, and much higher. In the passage between are soundings of 6 to 18 in the middle, and, decreasing near Branco, to 7, fathoms. The latter is a narrow island, $2\frac{1}{2}$ miles long from S.E. to N.W. A spit of sand stretches from its S.E. end, on which the rollers or break is violent, and its shore is altogether rocky.

Praya Branco, on the N.W. side of the island, has a small village of about thirty stone-built houses, thatched with reeds. The scenery here, being on the side of a stupendous mountain, is picturesque and magnificent; a small stream of water supplies the village; bananas and papayas are planted on the borders of the brook; cassada and vines on the banks of the valley; the latter grounds are so laid that they can be irrigated; for which purpose the soil is supported on its different levels by stone walls, about three feet high. Sugar canes are cultivated in small quantities. The bread is made from maize or Indian corn, and from farina, or flour of cassada. The natives are in general poor, but very courteous.

Monte Gordo, or the Broad Mountain, is in the central part of the island, toward the west. Its summit is 4200 feet above the level of the sea. The mountain is composed entirely of volcanic matter, very fragile and porous, and does not form a peak like many of the smaller ones on the island. It is well clothed with vegetation, even to the summit. The *Euphorbium balsamifera* flourishes to about 3700 feet above the level of the sea.

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The prospect hence is very extensive, calm, and beautiful. *Mr. Forbes ; Capt. Owen*, Vol. I. page 27.

ST. LUCIA lies at the distance of $3\frac{1}{2}$ miles to the northward of Brapco, and the Bank of soundings extends to this island. The bank here forms a regular flat of 10 to 13 fathoms. The south coast trends nearly East and West 4 miles, and in the middle of it is a good landing-place. A steep bank, half a mile broad, stretches from it, having on its edge 2 to 4 fathoms. In the bay formed by the S.W. coast, are the ruins of a village, at three-quarters of a mile from the south point. To the westward of this is a little islet named *Leon*. The N.W. part of St. Lucia rises into high mountains.

Captain Bartholomew describes St. Lucia as of moderate height, with a bay on the S.W., where small vessels may anchor ; being sheltered from all points but South and S.E. The beach is sandy ; the anchorage, small pebbles and sand. In the middle of the bay is an islet, named *Leon*, with the ruins of a village on it, and frequented by fishermen only. There are many turtle here, and much orchilla is gathered, with some cotton, in a wild state.

These islets are occasionally visited by parties from the other islands, for the purpose of hunting wild bullocks and goats.

ST. VINCENT'S.—The island of St. Vincent is separated by a channel, 4 miles broad, from that of St. Lucia, and by one of 7 miles from that of St. Antonio. This island is 11 miles long, from East to West, and about 6 broad. It has two chains of mountains, facing the N.E. and S.W., which form a central valley that terminates in the bay called *Porto-Grande*, upon the N.W. side of the island. The N.E. coast forms two bays, separated by a low peninsula, of two miles on either side, and this coast has been described as altogether dangerous.

PORTO GRANDE is the largest and best bay in the Cape Verde Islands : it is capable of holding 300 sail of large ships, well sheltered under the high lands, and has a fine appearance. *Lieuts. (since Captains) Vidal and Mudge*, who surveyed this place in 1820, say of it, that it now forms a good and safe anchorage, where you may strip and refit your ship ; as it is sheltered both from wind and sea. The wind generally blows from the N.E. over a part of the land, and seaward it is protected by the island of St. Antonio.

Wood is plentiful, and sufficient water may be obtained from the well, on the eastern shore, for daily consumption. After a refit here a complete supply of the latter may be found in the Bay of Terrafal, St. Antonio, which is 6 leagues to the westward, and reckoned the best watering-place among the Cape Verde Islands. Cattle may be had at Porto-Grande, but they are not very good. The church and custom-house are situate in the bottom of the bay on the east, and a signal post may be seen, erected upon a hill, at a short distance from the anchorage, which gives notice of whatever may be passing or approaching the island.*

Latitude of the Custom-House, $16^{\circ} 53' 33''$, long. $25^{\circ} 3' 19''$. Variation, $17^{\circ} 46'$, 1820.

Without the entrance of the bay, at nearly three-quarters of a mile from its N.W. point, is a remarkable steep islet, called *Bird Isle*, which, at a distance, appears round like a sugar-loaf. *Mr. Finlaison* says, you may run in on either side of it, and will find regular soundings thence to the shore ; depths from 30 to 10, 8, 6, 4, and 2, fathoms, to the beach. The ground is good, in most parts of the bay, and you may anchor any where in 7 or 6

* March 30, 1822.—“ On the *Leven's* arrival in Porto Grande we sent on shore to a few houses called a town, at the bottom of the bay, to inform the governor who we were and what were our wishes. We could find only one miserable Portuguese, the rest being all negroes ; but most of them appeared to be free. The whole population did not exceed 100, without any plantations near their houses, as the soil is so very dry and sterile ; but, on the sides of the mountains, in parts where there is water, they are said to have some good gardens. Indigo grows every where wild ; and with it they dye the coarse cloths which they manufacture from cotton, and which, if ever planted by them, appears to be left entirely to Nature's cultivation and care.

“ We pitched a tent upon the beach ; cleaned a well in a ravine, which, during the rainy season, is a water-course ; then landed the women and a party to wash. During our stay, the sea-breeze every day blew furiously over the hills to the N.E. of our anchorage ; and, although the whole bay is nearly land-locked, yet the surf is very high all round, except in one spot near the town. We, therefore, embarked only a tun and a half of bad water, and caught a few fish.”—*Capt. W. F. Owen*, Vol. I. 28.

fathoms

fathoms of water, sandy bottom, with coral branches. The water is very clear, so that you may pick out a clear spot for the anchor.

"Ships should moor with a kedge, as a very strong current commonly sets to the N.E. between Bird Island and the shore: and, as the N.E. wind is variable, at night it is impossible to keep a clear anchor, without this precaution; for the wind, at times, comes in strong gusts from off the land." *

Mr. Finlaison adds, "In running between St. Antonio and St. Vincent, we sounded in 42 fathoms, bits of coral mixed with sand and small stones. Within half a mile of Bird Island we had 42 fathoms.

"Having proceeded about 8 miles to the southward of St. Vincent's, 40 fathoms of water were found; and, on approaching *Still Bay*, at the S.W. side of the island, found regular soundings, ooze and sand, to 20 fathoms, nearly in the centre of that bay. We anchored in this depth, with the west Point of the Bay, W. by N. and its East Point E.S.E.: the distance between the two Points is $2\frac{1}{2}$ miles; regular soundings from the ship to the shore, and very good landing on the beach. The ground is perfectly clear of rocks, but the bay is open to the S.W. wind. Water is also to be got by digging for.

Captain Bartholomew describes the bay on the S.W. side as the *Bay of S. Pedro*, having a fine sandy beach, and he says that vessels may anchor in 10 fathoms, near the middle of the bay, or rather more to the westward. The anchorage is good in the dry season, and the inhabitants say there is plenty of wood and water. The American whalers frequent this place.

On the eastern side of the island is another anchorage, the *Praya da Gatta*, with a sandy beach, near which vessels may anchor in 6 fathoms; the bottom is clear, but a sea sets directly in when the wind is either N.E. or S.E., the island of Sta. Lucia sheltering between these points. This bay and coast are without wood, water, and inhabitants.

ST. ANTONIO.—This island, as already shown, lies at the distance of 8 miles to the N.W. of St. Vincent, and it appears, altogether, like an assemblage of high mountains, particularly to the west. It is 22 miles in length, from East to West, and about 11 in breadth, and its highest peak is estimated at 9,700 feet above the level of the sea.

Of the two highest mountains in the west, the *Sugar Loaf* is the most elevated, and both are commonly covered with clouds. According to the late survey, the Sugar-loaf stands in $17^{\circ} 4' N.$ and $25^{\circ} 20\frac{1}{2}' W.$ The island is very woody, but has plenty of goats, fruits, and salt; it produces wine, cotton, indigo, &c. There is a village, *Santa Cruz*, on its S.E. side, but the ground is not fit for anchorage.

Terrafal Bay, which is only half a league to the northward of the S.W. end of the island, has been already noticed (page 410) as the best watering-place in the Cape Verde Islands, and other refreshments may here be purchased. The edge of the bank, with 40 fathoms, is about one-third of a mile from shore. At a cable's length within are 50 fathoms, and it thence shoalens inward to 20, 8, and 4, fathoms: the latter near the beach. Latitude of the Landing and Watering Place $16^{\circ} 57'$; Long. $25^{\circ} 24' 48''$. Variation, in 1820, $16^{\circ} W.$

"This watering place of Terrafal Bay is one of the most convenient for the purpose amongst the Cape Verde Islands. The bay is spacious, and has a black sandy bottom. Vessels anchor in 20 fathoms, at three-quarters of a cable's length from the shore, sheltered from the N.E. and South winds and sea: and when the wind comes to the westward of South or North, there is always, from the extreme high land, a calm in the bay, the wind never blowing home, but only occasioning a swell to set in.

"From the high mountains over the bay a small stream descends, which is never dry; on the first level spot a large pond has been formed as a reservoir to receive the stream, with a sluice to conduct it to the sands between the flat and the beach, which is a gradual descent; the flat may be about 60 or 70 feet above the level of the sea, and is generally moist and cool. In the vicinity of the pool is a fine plantation of bananas, papayas, &c., and in the lower sandy grounds a cotton plantation, with some trees of the *asclepias procera*.

* In working between St. Antonio and St. Vincent, to Porto-Grande, you may stand to a mile off St. Antonio, and as near as you please to St. Vincent, as the current generally sets strongly through to the N.E.—*R. Keilor*.

Mr. Finlaison says, that ships bound through this channel, should keep over toward the latter, as no danger whatever is to be apprehended on that side.

Just above the beach is a well; and, when the water is let off from the pool, all the soil between it and the well must be saturated before any can arrive at the latter. The reservoir, it appears, was formed with a view to water the plantation only, but the crews of the small trading vessels which take off the orchilla moss dug the well below, rather than have the trouble of going to the pool. Three huts are used as orchilla stores for *Mr. Martinez*, who farms that weed.

"The negroes, at first, mistook our vessels for privateers, and would not, therefore, assist us in obtaining water. We were, consequently, obliged to employ our own people to keep it turned into the pool, and to open the sluice to obtain our supplies, which were completed in the course of a day, and the next morning we sailed for St. Iago.

"In going out of the bay the wind was light, and we warped out by sending a stream-anchor ahead, with two hawsers on end, where it was thrown overboard, the boat having had a depth of 35 fathoms the instant before; but it appeared to have fallen over a precipitous cliff similar to that which lined the beach half a mile within it; for the anchor would have carried out cable, seemingly, as long as we would have veered it, and the boat could get no soundings with 60 fathoms: the consequence was that the hawser was cut through at 30 or 40 from the anchor, and lost.

"We inferred from this that the superstructure of this volcanic island was quite similar to that below the surface of the water: in short, that it was but the summit of an immense mountain, whose base may be as far below the surface as if it were an iceberg. As the highest mountain of St. Antonio is 8000 feet high, and as the mean height of the island may be taken at 1500, the base may be three or four miles deep. But as these speculations constituted no part of the object of our voyage, we made the best of our way to Porto Praya, and were caught between the islands with a calm and thunder squalls."—*Captain Owen*, vol. i. 30.

Of St. ANTONIO, Captain Monteath has said, "This island, the north-westernmost of the Cape Verdes, is high, and may easily be descried, in clear weather, at the distance of 18 leagues; by distances between the nearer limbs of the ☉ and ☽, 27th Feb. 1818, taken when the S.W. point bore N. by E. $\frac{1}{2}$ E., distant 25 miles, I made the longitude $25^{\circ} 35' 45''$ W.; and, by chronometer, $25^{\circ} 30'$; the mean of which places the S.W. end of the island in $25^{\circ} 25'$ W. From the atmosphere being hazy in the horizon, I was prevented from ascertaining the true bearing of the S.W. point at the time of observation; but, from bearings taken previous, with the ship's run corrected, I am inclined to believe $25^{\circ} 25'$ W. to be nearly the true longitude, and not $25^{\circ} 35'$, as had been previously stated."

After passing St. Antonio, as above, Captain Monteath, between the parallels of three and two degrees North, found the current to set S.E. by E. in the twenty-four hours; but, between 4° and 14° S., the ship was set, by the Equatorial Current, 80 miles westerly in five days.

Captain Monteath adds, "*On approaching St. Antonio*, which is very high, and may be discerned in clear weather at a great distance, it appears black, rocky, and barren; consisting of immense rocks or mountains, heaped on each other, and rising far above the clouds, which, in general, cover a great portion of their summits. On the N.E. part of the island the mountains are divided by deep ravines and gullies, which have every appearance of deep water having passed down them: on rounding the N.E. point you will perceive to the S.W., large white patches from near the shore until about half-way up the mountains; at this distance they are not unlike ripe fields of corn; but, on nearing them, they are found to consist only of large white rocks, like pumice, and are entirely destitute of verdure; the mountains toward the centre of the island are composed of rocks of stratified basalt, in thick and perpendicular columns, to their very summits: it also rises more gently, for a considerable elevation, than either the N.E. or N.W. ends, but without verdure, excepting a few tufts of brush-wood near the shore and patches of brown heath, with which the island is generally covered. From the N.E. point, until rounding the point of Sta. Cruz, the only habitations I could discern were two or three miserable-looking huts built upon the shore, about a mile distant from each other.

"After rounding the point on which the town of Sta. Cruz is laid down on the charts, I kept a good look-out, expecting the fort or town to open to view: but was surprised at not seeing any appearance of either. However, after a minute search with the spy-glass, I did observe a few negro-huts among a quantity of brush-wood, in a small valley near the shore, and in which there appeared to be a little verdure; this was, in fact, the only place which I ob-

I observed green in any part of the south side of this miserable island ; and this, I suppose, must be the town of Sta. Cruz.

"The S.W. point is pretty well covered with brush-wood, but I saw no signs of cultivation nor inhabitants. The channel between this island and St. Vincent's is quite clear of danger, and within a short distance of the shore on each side (except off the point of Sta. Cruz, where the breakers run out about a mile) is bold-to, and I should apprehend that a vessel might work through this passage with little risk, either by day or night."

REMARKS MADE ON QUITTING CAPE VERDE ISLANDS, AND CROSSING THE LINE. *By Captain James Grant, R.N.*

"On the 27th of April, 1800, we bade adieu to the Cape Verde Islands. On getting clear of the islands we found a strong current setting to the South, which differed our latitude, by observation, 30 miles more to the South than our distance would give."

"On approaching the line, we found various currents, with heavy squalls, and sometimes rain.

"On the 17th of May we had an observation at noon, which gave us latitude $8^{\circ} 11' S.$ and longitude $27^{\circ} 28' W.$ The wind in general at S.E. and S.E. by S. I followed the directions of M. D'Après, and the observations of Captain Cook, keeping a good point free, as I thereby expected to get the sooner to the South, and clear of the S.E. trade-wind, having crossed the equator in the longitude $20^{\circ} 30' W.$; by this we did not see any part of the coast of Brasil. It may be proper to remark that, we found a current drifting us farther to the West than we had any reason to expect, and that the vessel's head was never farther to the West than S.W. by S., and sometimes S.W. by S. $\frac{1}{2}$ S., which, with 13° West variation, ought to have given us, with a S.W. by S. course, by compass, a S.S.W. true course; instead of which we have never been able to make better than a S.W. course. Of this I am the more certain, because we have not, these twenty-four hours, had occasion to steer on any point but one, S.W. by S. with a S.E. wind, and with every attention I could pay to the steerage. Such is the result of my observation. It is true that all voyage-writers, who have navigated for the purpose of discovery, take notice of the different currents about the equator, without being able to reduce them within any certain bounds or rate: and I much fear that this will always remain a source of error. These currents, as already observed, set to the westward; therefore I think our navigators in general, who cross the line at about 20° or 21° West, might do it to more advantage at 12° , as by that means they will equally avoid the heavy weather experienced on the African shore.

"On my return to Europe, I found the winds as favourable for crossing the line in nearly the longitude 12° as I did in 20° ;* and, as the great point is to get into the variable winds, between the S.E. and N.E. trade, to cross, I found them equally so; neither had we more rain. If a vessel, therefore, crosses at about 12 degrees, she will not have so far to run to the West before she gets clear of the S.E. trade; and, if bound to the Cape or India, where it may be acceptable to have a sight of the former, or of the land near it, she will greatly shorten the passage, as it is well known that many have fallen in with Cape St. Augustine or C. Roque, on the Coast of Brasil, and, by so doing, were obliged to run from continent to continent, merely because they judged it useless or impracticable to cross the line under 20 degrees West. Independent of all this, there is another reason why, at certain seasons, the Coast of Brasil ought to be avoided; that is, between the months of February and July, when the winds hang much to the South, being generally from S.S.W. to S. by E. and S.S.E. This is an old remark made by many, but not generally mentioned by navigators who have laid down directions for navigating these seas. The current on the coast of Brasil, from March to September, sets to the north; and from September to March, back again to the South. No doubt, in doubling the capes Roque and St. Augustine, the currents extend themselves more to the East, of which we had a sufficient demonstration, enabling me to account for the remarks already made.

"On the 18th, we were in latitude $9^{\circ} 50' S.$, longitude $28^{\circ} 28' W.$, by lunar observations. Ever since the 12th instant, we had no other than S.S.E. and South winds, blowing at all times very heavy and squally, with rain. This had impeded our course to the South

* This corroborates the remarks of M. la Perouse, page 97, and of M. D'Après, pages 236, 237.

very much, and carried us a long way to the West. Between the third and seventh degrees of South latitude, we observed the diminution of the strength of the current to the West."

REMARKS ON SAILING WESTWARD OF THE CANARY AND CAPE VERDE ISLANDS AND TOWARD THE LINE. *By Captain Flinders, in the Investigator, 1801.*

"At day-break, 9th August, 1801, the island Palma was in sight, bearing S. 72° E. *true*, 10 or 12 leagues. Albacores and bonitas now began to make their appearance, and the officers and men were furnished with hooks and lines, and our harpoons and fizzes were prepared. This day I ordered lime-juice and sugar to be mixed with the grog; and continued to be given daily to every person on board until within a short time of our arrival at the Cape of Good Hope.

"We carried fair, and generally fresh, winds until the 15th, in the morning, when St. Antonio, the north-westernmost of the Cape Verde Islands, was in sight. At eight o'clock the extremes bore N. 69° E. and S. 13° W., *true*, and the nearest part was distant four miles; in which situation no bottom could be found at 75 fathoms. A boat was observed near the shore, and our colours were hoisted, but no notice appeared to be taken of the ship.

"The north-west side of St. Antonio is four or five leagues in length, and rises abruptly from the sea, to hills which are high enough to be seen fifteen or more leagues from a ship's deck. These barren hills are intersected by gullies, which bore marks of much water having passed down them. By the side of one of these gullies, which was near the place where we lost sight of the boat, there was a path leading up into the interior of the island. The S.W. and South points are low; they lie N. 14° W. and S. 14° E., *true*, and are five or six miles asunder. Between them the land hollows back, so as to form somewhat of a bay, which, if it affords good anchorage, as it is said to do, would shelter a ship from all winds between North and E.S.E. We did not observe any beach at the head of the bay; perhaps from having passed at too great a distance.

"Some distant land opened from the south point of St. Antonio, at S. 75° E., *true*, which I took to be a part of the island of St. Lucia.

"During the three days before making St. Antonio, the wind varied from the regular N.E. trade to E.N.E., and as far as S.E. by E.; and, at about the time of making the land, it dwindled to a calm. For three days afterward it was light and variable, between North and S.E.; after which it sometimes blew from the N.W. and S.W., and sometimes from the eastward. These variable winds, with every kind of weather, but most frequently with rain, continued until the 23d, in latitude 11° N. and longitude 23° W., when a steady breeze set in from the south-westward, and the weather became more settled and pleasant. The clouds were sufficiently dense to keep off the intense heat of the vertical sun, but did not often prevent us from obtaining daily observations for the latitude and longitude. At the same time with the S.W. wind came a swell from the southward, which made the ship plunge, and opened her leaks considerably.

"The south-western winds continued to blow without intermission, and drove us, much against my inclination, far to the eastward toward the coast of Africa. One or two attempts were made to go upon the western tack, but this could not be done with any advantage until the 2d of September, when we were in latitude 3° 50' N., and longitude 11° 15' W. The wind had veered gradually round, from S.W. to South, as we approached the African coast, to the direction of which it kept at nearly a right angle. I had not fully adverted to the probability that the winds blowing upon this coast would prevail to a greater extent at this season, than at any other time of the year; otherwise, as I wished to avoid Africa, I should have passed some degrees to the westward of the Cape Verde Islands, and probably have carried the N.E. trade to the 12th, or perhaps to the 10th, degree of North latitude; and in 8°, or at farthest in 6°, the S.E. trade might have been expected.

"Captain Cook, in his second voyage, experienced the same south-western winds, and was carried so far eastward, that he crossed the equator in longitude 8° West. M. de la Perouse also experienced them, and both were here at the same season with ourselves; that is, in the months of August and September, when the African continent had received its greatest degree of heat.*

* See the preceding remarks, by M. de la Perouse, page 97.

"Although I preferred to avoid Africa, it is by no means certain that a good passage to the Cape of Good-Hope may not be made, especially at this season, by steering round the Bight of Benin with the S.W. and South winds. It is probable that, on approaching the meridian of Greenwich, the wind would be found to return to the south-west, and perhaps more westward, and enable a ship to reach the 10th degree of South latitude before meeting the S.E. trade; in which case, the circuit to be made before attaining the western winds, beyond the southern tropic, would be much shortened." [Voyage, Vol. I. p. 28.]

8.—BERMUDAS' OR SOMERS' ISLANDS.*

THESE islands received their first name from Juan Bermudas, a Spaniard, by whom they were discovered in the year 1503; and were called Somers' Islands, from Sir George Somers, one of the first settlers, who was shipwrecked on their rocks in 1609, in his passage to Virginia. They extend N.E. by E. and S.W. by W. about 16 miles in length, and of various breadths, being shaped in the most irregular manner imaginable. They are surrounded with many dangerous rocky reefs, nearly even with the surface of the water, some of which extend above 8 leagues from the islands, and render them very difficult of access. What renders the approach still more dangerous is, that the land is low, and a current often sets toward them from the S.W. The current is variable, but it is known that vessels have been carried by it out of their reckoning to the distance of many leagues.

The Bermudas have been celebrated for the beauty and richness of their vegetable productions, as well as for salubrity of air: but, during S.W. winds, which are the prevailing ones, the atmosphere is very damp, and if the constitution contains a germ of disease, it is then sure to manifest itself to the rheumatic, the gouty, and those subject to pulmonary affections. The population of the isles is between 9000 and 10,000, of which about half are whites, and of these two-thirds females. It has been said that, with half its number of negroes, the colony would be more prosperous.

"The winter, or cold season, at Bermuda, is the most agreeable, and lasts from November to March; the mean temperature being 60°; the predominant winds are then from the westward; if to the northward of this, fine hard weather, with a clear sky, accompanies them. This is the favorable time for refitting ship, painting, &c. Thermometer, 50° to 56°. The close of this is often a very fine bright day, with little wind and partial calms, when the wind is certain of going round to the S.W.; the weather becoming hazy, damp, subject to heavy rains and gales. The thermometer immediately attains 66° to 70°. These alternate northwesterly and southwesterly winds prevail through nine months of the year; the wind remaining at no other point for any length of time. This change is exhibited by a difference of 14° in the temperature. At this season it seems advisable for ships bound to the southward to wait and take the first set in of the northwesterly winds. In most cases it will insure a quick run to the variables, and often to the trades."—*Mr. H. Davy.*

The islands are divided into nine parishes, and each parish sends four members to the House of Assembly. The towns are *St. George's* (formerly the capital) and *Hamilton*; each has a mayor and other civic officers. The seats of the senate and courts of justice are at the latter. The town of *St. George* is seated on an island of the same name, which is the north-easternmost of the islands. *Hamilton* is on a harbour of the same name, in a central situation, to the westward. The people are, in general, humane and hospitable. Their principal employ is building of sloops and small vessels.

Hurricanes and tempests are very frequent; as is to be expected from the proximity of the isles to the variable limit of the trade and other prevailing winds. Few autumns pass without hurricanes of more or less violence.†

There

* For some remarks on the currents about these isles, see page 181.

† The BERMUDA SQUALLS are sudden and violent tempests experienced near the Bermuda islands, particularly in the winter season.

As the day closes, the whole horizon becomes obscured by dark and heavy clouds, and the thunder and lightning which precede the first squall, give notice of its approach. After the commencement, the wind, continually shifting, blows in tremendous gusts at intervals of every 20 or 30 minutes, a dead calm intervening; and the sea rising in confused and breaking waves, renders the situation of a vessel, particularly a small one, very dangerous.

The conduct pursued by seamen, and which appears to be the most advisable under such circumstances,

There are a few wells on the islands, but no fresh water streams. The water from the wells is brackish, and does not agree with Europeans: but every house has a tank attached to it, the roof acting as a conductor in the rainy season.

Much live stock, flour, maize, and corn-meal, for the use of the inhabitants, is imported from British America: yet there is scarcely any vegetable which the Bermudas cannot produce, as potatoes, onions, cabbages, carrots, turnips, peas, French beans, pumpkins, melons, &c. The citron, sour orange, lemon, and lime, grow spontaneously, in great luxuriance, and the arrow-root is said to be superior to that of any other place. Coffee, indigo, cotton, and tobacco, also flourish here. But, of 12,000 acres which Bermuda is said to contain, not more than 200 have been disturbed by the spade or the plough.

The whale fishery, at an expense comparatively trifling, is carried on about the isles. One good fish covers the expense of the season, and sometimes six or more are taken. The season commences in March and ends in June. On the south side of the isles the whales approach within a mile of the land, and during the season men are stationed on the cliffs to give intimation when one appears.

Fresh butter and milk are produced in sufficient quantities to meet the general demand, but no more cattle nor sheep are reared than are sufficient to keep up the stock. Excellent fish, in great variety, abound on the shores. Many small turtle are also taken during the summer, and are sold at a moderate price.

There are four SIGNAL STATIONS on the islands: One at *St. George's*, the head-quarters on the east; central at *Mount Langton*, near Hamilton; another on the *S.W. coast*, at three miles from the S.W. end of the islands; and another at *Gibbs' Hill*, on the west coast. At each a small party of soldiers is stationed. There is, also, a flag-staff at the Commissioner's house at the Dock-yard in Ireland's Island, toward the west, near which a detachment of engineers and two companies of the line are stationed.

SAILING DIRECTIONS, &c.*—Vessels, in hazy weather, or in the night, must be very cautious in approaching, lest the wind or currents should set them on the reefs, or into some inextricable channel. Be particularly cautious in coming from the S.W., as upon the rocks off this end of the island, from S.W. to W.N.W., many ships have been lost. No stranger should attempt any of the anchorages without a pilot; many of whom are always on the look-out, and put to sea when a vessel heaves in sight. Their boats may be readily known, being of a peculiar construction and rig; of a light draught of water forward, with a long heel or deep sternpost: rigged with one mast and bowsprit, carrying a triangular mainsail, a foresail, and jib, and, occasionally, a gaff-topsail and square-sail.

The prevailing winds with fine weather in these seas, being from between the South and West, vessels from the West Indies and America generally make these islands by running in their latitude from the westward. The best latitude for that purpose is $32^{\circ} 8'$, always having regard to a small probable current in the direction the wind blows; steering East, you will first see the land a little on the larboard bow, being two small sand-hills, close together, having a white house on the top of one, and cedar-wood on the other, (these are called *Gibbs' Hills*): as you near the land, you will see *Wreck Hill* farther to the northward, appearing peaked, and joined by low land to that first seen; steer to bring *Gibbs' Hill* to bear E.N.E., and, when within 6 miles of the land, take care it is not to the eastward of that bearing, because of the rocks called the *Long Bar*. Then steer so as to pass within two miles of the south-east land; and, when *Wreck Hill* shuts in behind the south land, you are clear of the south-west breaker, and may steer along the south-east side of the island, at a mile distant from the shore, until abreast of *St. David's Head*, there being nothing to hurt a ship but what is in sight.

In running for BERMUDAS from the eastward, the best parallel is between latitudes $32^{\circ} 10'$ and $32^{\circ} 20'$; in which a ship may run boldly, as there are no rocks at any distance from the land.

stances, is to furl the ships' sails, and endeavour to get before the wind; by which means she may ultimately run clear of these local squalls into a steady breeze. It is an observation made by seamen who are familiar with the Bermuda Islands, that the various winds which blow meet there, and contend for superiority; and the inhabitants themselves remark, that the currents about their rocks, are as variable as the winds, and as numerous as their islets.—*Lieut. J. Evans*, "Revision of Geographic Terms," p. 109.

* These directions were originally communicated to the Trinity-House by the late Mr. Murdo Downie.

When running down a parallel for Bermudas, with a large wind, and not making the land toward night, but expecting to be near it, no vessel in this situation ought to lie-to, but should rather turn to windward, under an easy sail until day-light, because of a probable current, as before mentioned, which has deceived many by bringing them unexpectedly among the rocks. The land not being high, (for Gibbs' Hill, the highest land in the islands, is but little more than 180 feet above the level of the sea,) it cannot be seen at any great distance from a small vessel; add to this, the thick haze that frequently prevails here, particularly in fine weather, renders making the land somewhat difficult, and, at times, precarious, unless the latitude be accurately ascertained; for instances have happened of vessels missing the islands; and, after a fruitless search, steering for the American Coast, in order to take a fresh departure for running down the latitude again.

The rocks and islands of Bermudas lie N.E. by E. and S.W. by W. about 9 leagues, and, in breadth, about 5. *Wreck Hill* forms the West Point, and *St. David's Head* the East. Round the West, N.W., and North, sides, is a continued and very dangerous ledge of rocks, beginning at the *Long Bar*, the south part of which lies 6 miles W.S.W. from Gibbs' Hill: trending then N.E. it is called the *Chub-Heads*, which, off *Wreck Hill*, lies 9 miles from the shore: the ledge hence rounds to E.N.E., and joins the North rock, which is always above water, and lies N.N.W. 12 miles from Catharine Point. From the North Rock the reef rounds East and E.S.E., and ends in *Mill's Breaker*, which dries at low water, and lies at N.E. 6 miles from Catharine Point, and N.N.E. from St. David's Head. The outer edge of this ledge is close and compact, leaving no passage through it for ships, excepting a small one near *Wreck Hill*, another by the North Rock, and one round Catharine Point. Round the outer edge of this ledge is a margin of soundings, of from one to two miles broad, having from 9 to 14 fathoms on it; there are, likewise, soundings for two miles from the shore round the N.E., East, and S.E., sides of the island; but, as the water here is deeper, it would be prudent for those who suspect themselves near the longitude of Bermudas in the night, or in thick weather, while between the latitudes of 32° and $32^{\circ} 40'$, to keep a lead constantly going: being assured, that, at 14 fathoms, they will strike the ground in time to avoid danger. The lead might be incased with tallow, for the greater certainty of striking ground: this precaution, I am persuaded, would prevent many of the wrecks that constantly happen here.

There is a rocky bank lying from S.S.W. to S.W. from Gibbs' Hill, (or S.W. part of Bermudas,) from 3 to 5 leagues distant: with various depths we struck ground upon it in from 17 to 45 fathoms, and several of Admiral Murray's squadron grounded upon it.*

Admiral Murray's Anchorage lies on the S.W. side of Catharine Point, extending from Tobacco Bay to the Ferry, between St. George's and the Great Bermudas: whence, after going through a passage to the westward, there is secure anchorage from abreast of Brackish Pond, across the entry of the Great Sound, as far as Ireland. The common entry into Murray's Anchorage is through an intricate and narrow passage round Catharine Point: for the particulars of which see the Chart, as no description can be given here that will be of any use to a stranger. The ground in the entry, as well as all over the anchorage, consists of stone, of the soft dripstone kind, ground as fine as flour, mixed with a shelly substance, and a chalky clay: it is very heavy, therefore the anchors do not sink deep in it, and they loosen immediately when a-peak: but it is rare that ships drive in it. I have, in the *Resolution*, a 74-gun ship, rid many heavy gales in this anchorage, but never started an anchor; although, in Hampton Road, Virginia, which has remarkably tough ground, the anchor has often come home. Ships bound for Murray's Anchorage will generally get a pilot off Castle Harbour, or they may run as far as St. David's Head. When to the eastward of St. David's Head, stand no farther to the northward than to bring the Head N.E., or you will see a white sandy bay to the southward of the Head, between it and Castle Harbour. In standing to the northward, care must be taken to shut no part of this bay in behind St. David's Head. The west land of Bermudas will be shut in behind the

* The dangerous rocky reefs extend, in some parts, eight leagues from the islands, and render them very difficult of access. What renders the approach more dangerous is, that the land is low, and the currents around are variable.

The banks to the S.W. were surveyed, in 1829, by the officers of H. M. sloop *Columbine*; according to whom the northern extremity of the *Inner Bank* lies in $32^{\circ} 6' N.$ and $64^{\circ} 53' W.$; the S.W. in $32^{\circ} N.$ and $65^{\circ} W.$ The least water found was 29 fathoms, corally and rocky bottom. On the edges are 40 fathoms. To the S.W. of this bank is another, called the *Outer Bank*, the N.E. end of which is in lat. $31^{\circ} 59\frac{1}{2}'$, long. $65^{\circ} 2\frac{1}{2}'$; the S.W. end in $31^{\circ} 57'$, and $65^{\circ} 5'$. The least water found on this bank was from 33 to 47 fathoms, rocks and coral.—*Colombian Navigator*, Vol. I., p. 8. (See page 67.)

land, over this bay, before this mark comes on. In the night, when waiting here for a pilot, the best precaution is the lead; for, if care be taken, and the ship is not running too fast through the water, you will be sure of striking ground in time to avoid danger. There is another passage, past the North Rock, into Murray's anchorage, and frigates have gone out through this passage, but I am not acquainted with it. This passage being nearly in an opposite direction to that round Catharine Point, the wind will be fair in it when it is foul in the other, and *vice versa*.*

The FOLLOWING INSTRUCTIONS for sailing to BERMUDAS' ISLANDS, are those issued by Admiral Murray, when on this station, to ships bound from Virginia and the Carolinas.

"Within the Gulf-Stream steer well to the southward, perhaps as much as S.S.E. until you get within 3 or 4 miles of the latitude of Cape Hatteras; and then steer S.E. by E. until you get into the latitude of $32^{\circ} 5'$. Thus you will avoid crossing the Gulf-Stream where it is very broad, and its direction far to the eastward, and pass it where it affects your latitude more than your longitude; and, of course, be of less consequence to the ship's reckoning: and, by steering thence so far to the southward as S.E. by E., you will fall into the latitude of the Bermudas, at 4 or 5 degrees of longitude to the westward.

"You should by no means run for these islands unless sure of your latitude; and always make them from the S.W. if possible, looking out in time for the land: as, owing to the set of the Gulf-Stream, and the general tendency of the currents to the eastward, ships from the coast of America will almost always be far a-head of their reckoning.

"Having ascertained your latitude, and being well to the westward, get into the parallel of $32^{\circ} 5'$, and steer due East: this course will bring you to the islands, passing about 4 miles clear of the south end of *Chub-heads*; a very dangerous shoal, lying across the west end, about 8 miles from the land, with not more than 12 feet on it at low water, as well as the S.W. breakers, which lie about one mile and a half S.S.W. from the southernmost land, being the shoalest part of a ledge of rocks, of considerable length, lying parallel with the shore. Should the wind, in the night, incline to the northward, keep in $32^{\circ} 7' N.$; but, if to the southward, in $32^{\circ} 2'$.

"The soundings do not extend more than a mile and a half from the shore on the south side; therefore you have only a strict look-out to depend on for safety: and, as for the East, West, and North, sides, the breakers lie from 3 to 4 and 5 leagues off. You must avoid, by all means, running in the night, without having a good observation the preceding day, and being pretty sure of your longitude. Follow these directions, and you will first make Wreck Hill, (which is high land on the western extreme of the islands,) and the land trenching from it to the S.E. Having passed the S.W. breakers, the land lies about E.N.E. and W.S.W., having danger no more than half a mile off, and that generally visible: you may run safely along shore at a mile, until you pass Castle Harbour, which is easily known by the castle on an island on the starboard hand. You should bring-to off the eastern point of this harbour, and wait for a pilot, who will soon come off, and carry you into St. George's Harbour. But, should you be pressed for time, or the pilot not come off, you may haul round by the breakers, after having passed the islands which form the south part of Castle Harbour, into St. George's Road, bringing on the following marks:

"A high island, next to the N.E. part of the small ones off Castle Harbour, has, at its eastern extremity, a bluff rocky point, called St. David's Head, having breakers off it about half a mile: the northernmost land in sight, after you haul round St. David's Head, is called St. Catharine's Point: bring this point to bear W.N.W., and St. David's Head S. $\frac{1}{2}$ W., and you will be in as good a berth as any in the road, with 7 or 8 fathoms of water; but, in every part of these roads, you must be guided by the eye where to drop your anchor clear of foul ground, which is every where easily seen, owing to the clearness of the water and the whiteness of the sand where the anchorage is safe.

"In case you have been driven to the eastward of the islands, (a situation, however,

* The entrance to Murray's Anchorage is regularly buoyed. From this anchorage ships may proceed south-westward to *Grassy Bay*, or to *Ireland's Island*. On the latter is the naval establishment and dock-yard, the general rendezvous for the king's ships. But this place is considered by many of the pilots as not having been judiciously chosen, the channel to it from Murray's Anchorage having been reduced in width and depth of water by the influx of sea-weed into the Great Sound on the S.W., and the rapid growth of coral: besides, ships of war have, at times, been detained here several days by the wind, before they could get out to sea by St. George's Island.—*Cotter's Sketches of Bermuda*, 1828.

which you are to avoid with the utmost care,) you may run for them in latitude $32^{\circ} 14' N.$, which will bring you to them 5 or 6 miles to the southward of St. David's Head, for which you may haul up upon making the land; but you are not to run in till you are far enough to the S.W. to follow the directions before given for coming from the westward, should you make sail for Bermudas from any part of the Gulf-Stream, or without it.

"I recommend to you to make great allowance for your being to the eastward of your reckoning, and try to fall into the parallel of latitude above mentioned, in longitude 70° or $71^{\circ} W.$

"High water at St. George's, full and change, $8\frac{1}{4}$ hours. Spring tides rise about 6 feet, common 4 feet. The tides are various, both in height and time, at different parts of the islands. The Bermudas bear from Cape Henry S. $63^{\circ} 35' E.$ distant 210 leagues."

Directions for Sailing near the BERMUDAS, on coming from the Westward.

"On coming from the westward, the S.W. points of the land ought to bear E.N.E. before you come within four leagues of the land, when you may steer directly for it without danger. The breakers, on the south side, always show themselves; so that a ship may safely approach within gun-shot from the S.W. end to the S.E., and, when getting to the eastward of the castle, round into St. George's. Do not go farther to the northward than to keep Cooper's Island open within St. David's Head till you take a pilot: and the subscriber engages no ship will ever strike, if this be attended to.—*Thomas Lean.*"

9.—THE COASTS AND ISLANDS OF AMERICA, IN GENERAL.

For a complete and correct description of the Coasts of Newfoundland, of the Gulf and River of St. Lawrence, the Coast of Nova Scotia, &c., to Cape Cod, the reader is referred to the new Edition of the particular Directions for those Coasts, published by the Proprietor of the present work. The navigation thence to the southward, including the whole of the West-Indies and Mexican Sea, is described in THE COLOMBIAN NAVIGATOR.

As these have been lately revised, the Editor has little to add to the instructions already given. The American navigation, in general, requires details so minute, and explanations so copious, as to render it impracticable to do justice to the subject in an abridgment; and he does not pretend to attempt it, being convinced that it would not answer the desired purpose.

The general explanation of the passages over the Atlantic, to America and the West-Indies, as given in the preceding part of this work, show how these passages are controlled by the prevailing winds and currents; and how the general courses should be regulated in the different seasons. All, therefore, that we have now to add is, the situation of the dangers to be avoided in making those passages; and this will be found attempted in the following section.

SECTION IV.

DESCRIPTION of the ROCKS, SHOALS, and VIGIAS,* in the ATLANTIC; and of the Authorities on which they have been inserted in the Chart: including REMARKS on ICEBERGS, ICE-ISLANDS, &c.

GENERAL NOTE ON THE VIGIAS, &c.—This section may, with propriety, commence in the words of M. de la Rochette; who has said, "We take upon us neither to

* VIGIA is a Spanish word, literally signifying *Watch*, or *Look-out*. It is, generally, in the charts, attached to spots supposed to be dangerous, and which should, therefore, be approached with caution.

certify the existence nor the position of all these vigias; as it is extremely possible to mistake one for another, or to repeat them, especially those of which the position depends on the estimate or guesses of mariners."

"It is, moreover, possible, that navigators, at a certain distance, may have mistaken whales for shoals. M. de Chabert, in his voyage to America, in 1741, for the purpose of making astronomical observations, being at the distance of 70 leagues from Corvo, one of the Azores, descried a dusky body, over which hovered a number of gulls, a bird seldom seen at such a distance from land: at first he imagined it to be a rock; but, on coming near, in order to observe it, he found it to be the carcass of a whale, of monstrous bulk. Besides, some of those vigias may have ceased to exist after having appeared for some time; as, for instance, the island, which rose out of the sea, in the year 1720, to the westward of St. Michael, of the Azores, and which disappeared again on the 17th of November, 1723."

As a monition against too hastily forming conclusions from mere appearances, we here add that an old friend of ours, in crossing the Atlantic, was once alarmed by the sight of breakers at no great distance. Instead of coming home with an imperfect report, he very properly sent out a boat to examine them, and found that they were caused by a floating body, thickly covered with barnacles, &c., to which a hatchet was applied, and soon disclosed a cask of wine, which proved to be excellent Burgundy. It had, no doubt, been floating many years, and during the time had probably been the prolific parent of a number of *vigias*, &c. On the 4th of August, 1822, Captain Hamlin, in the brig *Recovery*, likewise picked up a hoghead of claret wine, that had been a long time in the water, and worm eaten nearly through, lat. $34^{\circ} 51'$, long. $24^{\circ} 51'$.

We have shown, in another work, how easily an animated as well as a lifeless being may be mistaken for a rock. In 1818, the *Northampton*, Captain Tebbut, on her passage to India, had passed the meridian of the Cape. On the 1st of August, at noon, the ship was in latitude $40^{\circ} 45' S.$, and long. $24^{\circ} 32' E.$ On the next day an object appeared right a-head, like a boat; on nearing, it looked like the wreck of a vessel, *two parts being above water*, at two ship's length from the lee-bow. The barnacles could be distinguished by the naked eye; but, when a-beam, the creature *went down*. It proved to be a *thrasher*. Captain Tebbut says, "Being forward at the time we came up with the animal, the two parts above water seemed to me like a wreck, bottom upward. When I first saw the barnacles, the part covered with them looked rugged, and I firmly was of opinion that it was a rock above water; so much so that I looked over the lee-bow to see that we were clear of it, ordering the man to starboard the helm."

A similar instance has been recorded in the *Journal of the Royal Geographic Society*. "A frigate was one day running into the Rio de la Plata, with her studding-sails set, when the look-out man at the mast-head reported breakers on the bow. The captain, believing that such a danger could not have escaped the notice of the Spaniards, and having, also, a tolerable chart of the river, suspected it must be some floating object, and ordered the ship to be steered directly for it. The officers were on the alert; glasses were frequently directed to the spot; and all concurred in representing it as a rock a little above water. Anxious looks were directed to the captain, whom they now considered unnecessarily running into danger; but that officer kept carefully watching his approach, and, as the studding-sail boom was just over it, the cetaceous monster (for such it was) hastily made off; and, rising again to blow, finally disappeared. It was observed to have an excrescence on its back, covered with shell-fish. The sea broke gently on its weather side, and appeared becalmed to lee-ward; and so perfectly did it resemble a rock that, had the vessel passed at a distance without disturbing it, there can be little doubt but it would now have had a place upon the list of vigias.

"It is to be observed, in this case, that there was only a little ripple about the body, but no breakers; and this circumstance had not escaped the intelligent eye of the commander."

In every event, however, it is always the safer course, in matters of this nature, to err rather by marking too many than too few, especially when we make known, as we have done, the authority that we rely on for the existence of each. Every one, of course, is free to act according to his own judgement.

I.—To THE NORTHWARD OF LATITUDE 50 DEGREES.

NUN Rock, off Cape Rath, in lat. $58^{\circ} 52\frac{1}{2}'$; and long. $4^{\circ} 56' W$.

This rock, with the adjacent bank, was surveyed, under an Admiralty order, by Captain Ramage, in the Cherokee sloop of war, 1817. According to Captain R., from the centre of the rock, over which there is but 15 feet of water, at low ebbs, Cape Rath bears, (by compass,) S. $32^{\circ} W$. nearly 15 miles; Farout Head, S. $10^{\circ} W$., 18 miles; Whiten Head, S. $6^{\circ} E$., $21\frac{1}{2}$ miles; the Stack, S. $85^{\circ} E$., 14 miles. For a farther description of the rock and bank, see our Memoir on the Northern Ocean, page 14.

AITKIN'S ROCK, to the West of the N.W. of Ireland? *

The original notice relative to this danger, or *imaginary danger*, was published at Whitehaven, 12th September, 1740. On the 16th of July, at seven o'clock at night, in a passage from Virginia, on board the *Friendship*, of Ayr, John Aitkin master, James Lockhart mate, coming in at the N.W. channel of Ireland, going under reefed foresail, wind at N.N.W., steering E. by S., saw, by the weather-leech of the foresail, a rock under water, about 4 feet, distant 40 or 50 yards, to the best of judgement, the ship running 6 knots by log, with a heavy swell from the N.W.; all hands being on deck saw it plainly: next morning made the land, betwixt Insterhul and Tory Island, at about eight o'clock. Supposed to lie in the latitude of $55^{\circ} 18' N$., and longitude, from the meridian of London, $11^{\circ} 14' W$. From Island Tory, West, distant 94 miles, without allowance of variation.

A second advertisement, relative to this rock, was published by Mr. F. Cumming, of New York, in the year 1793. "On Thursday, August 9th, 1722, ship *Nestor*, of Greenock, from New York, bound to Greenock, being in latitude, per observation, of $55^{\circ} 19' N$., and longitude, per account, of $9^{\circ} 53' W$. of Greenwich. The officers, passengers, and ship's company, who were then on deck, perceived a rock about four feet below the surface of the water, not five fathoms from the weather beam of the ship, in the form of a horse-shoe, with one side longer than the other; the mate instantly threw an empty barrel overboard; the yawl was got out as soon as possible, and the mate, four hands, and two passengers went into the boat, and were absent near two hours in search of the rock; but, owing to the ship's drift, and a dark cloud which then obscured the atmosphere, they could find neither rock nor barrel. The Rev. Mr. Stewart, then a passenger in the *Nestor*, saw the rock plainly, with the tangle growing on it.

We have other accounts of this rock; and of these one states its position at $55^{\circ} 15' N$. and $10^{\circ} 40' W$.; a part appearing at 3 feet out of the water, with soundings of 30 to 40 feet a short distance; at 30 fathoms off no soundings with a line of 150 fathoms. In or about the year 1804, Captain Clarke, since of the *Harmony*, of Ayr, believes that he saw the rock very distinctly; by his run it appeared to lie 20 leagues nearly true West from Tory Island. He thinks it is from one half to a whole cable's length long, and about 150 feet broad. The tangle appeared about one foot below the surface, at about dead low water, and the ship rubbed alongside the rock.

"In the *True Briton*, Wednesday, the 27th of September, 1826, when steering E.S.E. a man at the mast-head called out that there were breakers close to our larboard bow. I immediately hauled the brig up S.S.E. to clear them. In the run of the sea a rock appeared a little above the water, nearly flat, about 90 feet long, and 40 broad; saw no breakers excepting round the rock, and could distinctly see the sea working over the rock. We sailed from the rock 11 miles S.S.E. per compass, and ob. m. lat. $55^{\circ} 17' N$. We then bore up E.S.E. 36 miles, and E. by S. six miles, when Tory bore per compass S.W. $\frac{1}{2}$ W. $1\frac{1}{2}$ mile.

"Greenock, Oct. 8, 1826.

JAMES REID, (Commander.)"

Iver M'Iver, a rigger in Greenock, stated (in 1820) that many years before, while he was seaman on board a vessel, they fell in with Aitkin's Rock in fine weather. The captain caused the boat to be got out, and M'Iver was one of the men in the boat. He said the rock was not much under water, had sea-weed on it, and was about the size of a ship's launch, bottom upward.

* In this section, the note of interrogation [?] implies that either the position or existence of the shoal is doubtful.

Several other accounts of this rock have been given, as seen from different vessels ; and in consequence of all, the Chamber of Commerce of Glasgow addressed a letter to the Admiralty, in 1821, stating that no less than six vessels were missing from that port, and soliciting their lordships to cause an examination of the danger. The application was renewed in 1826 and 1827. In consequence, H.M. Sp. *Gannet* was on this service in 1824, the *Harrier* and *Badger* in 1827, and the *Pylades* and *Dispatch* in 1829 ; but the rock was not discovered.

Again, in 1830, the *Onyx* and *Leveret*, two gun-brigs, commanded by Lieutenants Dawson and Worth, and directed by Captain A. T. E. Vidal, were engaged on this service. "They put to sea on the 6th of June, when the moon was at the full ; and, commencing their examination at Tory Island, proceeded nearly along its parallel of latitude to the westward of all the given positions of the rock. The two vessels were always in company, and the general practice was to sail on parallel lines, distant from each other from one mile to one mile and a half by day, and closing at night to half a mile, or as much less as the state of the weather rendered necessary. During the few hours of darkness experienced at that season of the year, the vessels were hove-to, that no part of the suspected ground might be passed unseen, and the leads were kept going, both day and night, from the depth of 150 to 200 fathoms. Their distances from each other were determined every hour by the angle of elevation subtended by their respective masts, at the heads of which balls had been placed to facilitate the measurement. Their mutual bearings were taken at the same time ; and men were kept constantly at the mast-heads during the day, and a vigilant look-out preserved through the night.

"The parallel of latitude of Tory Island, as above mentioned, was first carefully examined to the westward of all the positions of the rock, and then traversed back again. These runs were laid down on the chart, and then other lines traced, until the whole space was explored as there exhibited. This system of crossing and re-crossing over every part of the suspected ground was persevered in until the 31st of August ; when, having visited every position assigned to this danger, and indeed the whole space comprehended by them, without seeing any rock, or discovering any detached bank, which could indicate its having existed, the search was relinquished, and the vessels returned to England."

To those, hereafter, who may have to make similar researches, it may be important to know that *Captain Beaufort*, (Hydrographer to the Admiralty,) in his instructions, had recommended that the vessels should sweep for the rock by laying out a large scope of hawsers between them, and drifting with it over the suspected ground. To effect this he suggested two methods :—the one, when the two vessels should be on the same tack, the leading brig keeping a little off the wind, with her main-topsail occasionally lifting ; the hawsers fast to her quarter, with a spring to them from her weather-bow ; the sternmost brig lying-to, with her main-topsail to the mast, the hawsers from her weather-bow, and a spring to them from her weather quarter. The other method Captain B. proposed was drifting on opposite tacks, the hawsers fastened to their sterns, with springs to them from the weather-bow of each vessel.

An additional number of hawsers were accordingly provided for the purpose ; and, upon the principles described, a line of them, amounting to more than 700 fathoms, was laid out, and a large portion of the suspected ground subjected to this mode of examination. To prevent the central part of this long scope from descending to too great a depth, and to relieve the vessels and hawsers as much as possible from the strain required to keep so much heavy rope in proper tension, the hawsers near the middle of the line were buoyed, at intervals, with empty water-casks.

Every part of the suspected ground was run and sounded over in open day-light, through the different phases of the moon, at all times of tide, and under every variety of wind and weather. Great pains were taken to explore it during the spring-tides, when it might be expected to be uncovered ; and, in short, the utmost diligence was exerted to bring this examination to a successful termination. This search, however, has failed to produce the rock ; and *though it is not presumed to assert that it has no existence*, yet it is hoped that a reference to the chart will justify the statement that it cannot occupy any of the situations assigned to it.

During the month of June, many of the mast-head men and others were momentarily deceived by the blowing of whales, which at that time were numerous ; and in August a small black object, a little above the surface of the sea, was productive of similar hope and disappointment. It was first seen from the *Leveret*, and on examination proved to be the trunk

trunk of a very large tree, with its roots projecting two or three feet out of the water. They were covered with weeds, barnacles, and other marine productions; and presenting a rounded top, abrupt on one side and sloping on the other, corresponded very minutely with one of the descriptions of the rock.—*Journal of the Royal Geographical Society*, Vol. I. pp. 51 to 58.

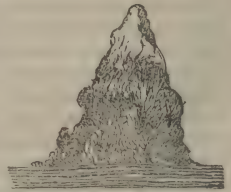
"Captain Vidal's researches do not convince me that Aitkin's Rock *does not exist*; for I have no doubt of M'Iver's having told the truth, and Captain Clarke is a man above suspicion; but it is very easy to pass a speck like it very close, and not see it; particularly at or near high water.—*Andr. Livingston.*"

BRASIL ROCK, in lat. $51^{\circ} 10'$, and long. 16° .

M. Bellin, in his Memoir of 1742, states, that this rock is marked in latitude 51° , and longitude $19^{\circ} 30'$ from Paris, according to Brouage, hydrographer, and Laisne, a pilot. It has been variously represented in different charts, although its existence has been doubted. Messrs. Verdon and Borda have added to their remarks upon this rock, that they do not believe it to exist. It was, however, seen in the year 1791, by the company and master of an English merchant ship, the commander of which favoured the editor of the present work with a description of it, stating that it is really a high rock, or islet, apparently bold-to, and to which he passed so near, that he could have cast a biscuit on shore. The longitude according to his computation, was about 16° W., but we suspect that, *if it exists*, it is more to the westward.

ROKOL, or Rockall; about lat. $57^{\circ} 37'$, long. $13^{\circ} 36'$.

This is a large and high rock, of a conical or sugar-loaf shape, the summit, or upper part, of which is perfectly white, from an immense quantity of birds' dung, with which it is covered. The rock has been seen many times, but its true situation was unknown till the year 1810, when it was ascertained by Mr. T. Harvey, master, and the other officers, of the *Endymion* frigate, commanded by the Hon. T. B. Capel. By the observations made by these gentlemen, on the 8th of July, it appeared that the longitude, per mean of 11 lunars, was $13^{\circ} 30'$ W., and the latitude, per meridian altitude, $57^{\circ} 40' 10''$. On the 8th August, the longitude, per mean of three chronometers, appeared to be $13^{\circ} 29' 30''$; by mean of five lunars, $13^{\circ} 31' 19''$: and the latitude, per meridian altitude, $57^{\circ} 38' 54''$. In Captain Vidal's chart of the western banks it is represented in $57^{\circ} 35'$ N. and $13^{\circ} 40'$ W.



Appearance of Rokol, 2 miles distant, as taken by the late Mr. Harvey.

With the rock bearing N. by W., broken water appeared about a mile to the N.E. of it; and, on approaching nearer, a rock, on which the water broke, appeared just at the water's edge. When due South of Rokol, the breakers were in a line with the eastern part of it. The variation of the compass, according to observations now taken, was $33^{\circ} 35'$ W.

The following remarks on Rokol were communicated to the public by Mr. Richard Peacock, in 1809. "This rock appears almost like a ship at a distance, and is steep close-to on the north side. I have passed at the distance of about 50 fathoms; but, to the southward, or nearly S.E. by E. from the rock, there lies a long reef of rocks for about 3 miles. On this reef, with gales of wind, the sea breaks very heavily.

"Captain Osborn, of Workington, told me that, on his passage from Quebec, in 1806, it was with the utmost difficulty he escaped getting amongst the breakers. Captain Magee, of Greenock, also informed me, that he had seen the sea break to the distance of nearly three miles in a S.E. direction from the rock."

Helen's Reef, to the N.E. of Rokol.—On a reef, until then unknown, and lying about two leagues, or less, E.N.E. $\frac{1}{2}$ E. (by compass) from Rokol, the brigantine *Helen*, of and from Dundee, struck fatally, on the 19th of April, 1824. This vessel, commanded by Mr. Thos. Erskine, was bound to Quebec and Montreal, with a general cargo, and after she had struck, the crew and passengers continued at the pumps for 13 hours; but, being overcome with fatigue, were at length compelled to abandon the vessel, as the leak was rapidly gaining on them, the water being within three feet of the hold beams. When lowering the long-boat, she unfortunately was stove in pieces against the vessel, with a tremendous sea. The crew, at that period 12 in number, embarked in two boats, with one passenger, and soon after they had left the vessel she sunk, when sixteen passengers perished,

perished, of whom seven were women and six children. The crew were picked up at sea by the bark *Flora*, Capt. Baker, from Dantzic to Liverpool, and safely landed on the Isle of Tiree, one of the Hebudes.

It appears, from Capt. Erskine's narrative, that he estimated Rokol to lie in 13° 40' W. That the vessel struck twice on a clump of rocks, apparently not much bigger than a ship's length, and on which the sea broke occasionally. No other breakers were in sight at the time. Rokol at this time bore, by compass, W.S.W. $\frac{1}{2}$ W., he thinks about 6 miles distant; but, as the weather was hazy, probably something less.

Another intelligent person has related that he had, about two years before, fallen in with the breakers to the S.E. of Rokol, which appeared to extend outward 3 or 4 miles, in clumps at some distance from each other.*

The ROKOL BANK has been surveyed by Captain Vidal. The edge of the bank of soundings, comprehending less depth than 100 fathoms, is 20 miles to the northward, and 35 miles to the southward, of the rock; and the least depth expressed, which is on the S.W. of the rock, is 54 fathoms. The whole extent of soundings, from N.E. to S.W., within the depth of 200 fathoms, is 55 leagues.

The greatest breadth, which is on the parallel of 57° 30', is 18 leagues. The north end of the bank, with 163 fathoms of water, is in latitude 58° 19', longitude 13° 40'; and the S.W. end, with 180 fathoms, is in latitude 56° 3', longitude 15° 59'. *Magnetic variation*, on the centre of the bank, in 1831, 33° W.

LION'S BANK, in lat. 56° 40', and long. 17° 45'.

This bank was sounded by Lieutenant Richard Pickersgill, in the brig *Lion*, in 1776, who found upon it from 290 to 320 fathoms. A vast quantity of sea-fowls were over it, and it probably abounds with fish. The position annexed is that given in the Requisite Tables. Dr. Forster, in his *History of Voyages* made in the North, says, "On the 29th of June, with 320 and 290 fathoms, Pickersgill found a sandy bottom, in 56° 38' N., and 17° 44' W., which induced him to call that spot *Lion's Bank*; and particularly so, as he found there, what is usually seen on all banks at sea, a vast quantity of sea-fowl, such as gulls, dumdivers, &c. Soon after this, he could no longer get any soundings, nor were there any more fowls to be seen. This bank is said to have been sounded on, a few years ago, by Captain Richmond, of Greenock.

KRAMER'S BANK, in about 60° 57' N., and 16° 40' W.?

This bank appeared in M. Bellin's Chart, of 1751, and was probably copied from the Dutch charts of the Greenland seas, which represented it as of considerable extent. It is said to have been discovered by Captain *Alof Kramer*, but whether dangerous or otherwise we know not. Captain Ross sought for this bank, but unsuccessfully, in 1818. This gentleman says, "Continuing our course, we came, on the 8th of May, to the spot where a bank is laid down in *Steel's Chart*, as discovered by *Alof Kramer*, but we could find no soundings in 130 fathoms, any where on or near the place." It may safely be erased from the charts.

N.E. LEDGE OF BELLE ISLE.—Captain Cook, in his directions, which accompany the North-American Pilot, has observed, "that ships steering for this island should be careful to avoid a ledge of rocks that bears N.E. $\frac{1}{2}$ N. [*about N. by E.*] from the east point of the island, distant 2 miles. Part of these rocks appear above water, and the sea always breaks upon them. You will have 20 fathoms close to them, and 56 between them and the island. All about this island are irregular soundings; but you will not find less than 20 fathoms home to the island, excepting on a small bank, lying N.W. by N. four miles from the N.E. end, whereon it is said are only 5 fathoms." Upon these rocks, &c. the icebergs are frequently aground, and completely obstruct the navigation of the Strait.

* Extract from the log-book of the *Emperor Alexander*, of Aberdeen, L. McKinnon, master.—April 8th, 1832, saw Rockall [Rokol] bearing W.N.W., distant four leagues; and Long Reef, breaking occasionally, bearing from the ship N.W. by W. $\frac{1}{2}$ W. (by compass) distant 8 miles, and about four miles from Rockall. At intervals the sea did not break on the reef, but it broke frequently very heavily, and with long rolling white seas, like breach upon a bar, for about 6 or 7 ship's lengths. The sea broke in no other place at that time within sight.—*Naut. Mag.* Dec. 1833, p. 697.

BETWEEN THE LATITUDES OF 40 AND 50 DEGREES.

ICEBERGS, ICE-ISLANDS, and Drift Ice.

Although we have, in a former work,* noticed the annual floats of ice which descend from the Northern regions, it may not be inapposite to recall to the seaman's mind the necessity of guarding against these tremendous and dangerous objects; more dangerous than permanent rocks, because unfixed; and more dreadful, because frequently obscured in snow and fog. They have been generally found on and to the eastward of the Newfoundland Bank, and between the parallels of 40° and 50° N.

"Navigating among them," as Captain Scoresby has observed, "in the gloom of night, has frequently been attended with fatal consequences: occurring far from land, and in unexpected situations, the danger would be extreme, were they not providentially rendered visible by their natural effulgence, which enables the mariner to distinguish them at some distance, even in the darkest night, or during the prevalence of the densest fog."†

The following instances, selected from many others, may operate as sufficient cautions.

On the 21st of June, 1794, in latitude $45^{\circ} 18'$, on the eastern steep edge of the Grand Bank, in a thick fog, at nine *a. m.*, his Majesty's frigates *Dædalus* and *Ceres* were suddenly involved amidst some very high and dangerous islands of ice. The weather was so thick, that objects were not visible at fifty yards distant. The *Dædalus*, commanded by Sir Chas. H. Knowles, hauled up and passed close to the stern of a ship that lay stranded upon one of the ice-islands, and sailed to windward of it through a great quantity of drift ice and to leeward of another ice-island. The *Ceres*, Captain Thos. Hamilton, passed in the same track, and saw the wreck a quarter of an hour after the *Dædalus*. The course was East, the wind S.W., the sea very high, as the wind blew hard the night preceding from the southward.

Again, on the 15th of June, 1810, the *Dædalus*, commanded by Captain Inglefield, with a fleet from Jamaica, in lat. $41^{\circ} 33'$, and long. $51^{\circ} 17'$, to the southward of the Grand Bank, passed two ice-bergs, and the next day another: providentially the fog, which had been very dense, cleared up for an hour, and allowed the fleet to clear the dangers. (*For the cases of the Eliza and Jupiter, about the same time, (1810,) see pages 214, 215.*)

On the 2d of August, 1813, H.M. ship Bedford, 74, then bearing the flag of Vice-Admiral Stirling, accompanied by the Cyane, 20, Capt. Forrest, and Fawn, 18, Capt. Fellows, with a fleet of 105 sail from Jamaica, at 8 *a. m.*, just as the fog cleared away, fell in with an extensive ridge of ice, having an iceberg at each extremity, and about one mile in extent, even with the water, over which the seas broke with considerable violence. Had the fog not cleared up as it did, about thirty ships must have struck upon it, as that number was steering directly for this formidable reef, and were within the extent of its sweep. The

* 'Memoir on the Northern Ocean,' &c. page 61. On the origin and nature of the ices, see the same work, pages 51 to 57.

† The following Remarks on the subject are from the pen of the late Dr. Sam. L. Mitchell, of New York:—"The raw and chilling quality of the atmosphere in the neighbourhood of floating ice, is invariably noticed by the navigators who have sailed among it. The prevalence of mist or fog on the land is very common when ice and snow, as they liquify, refrigerate a warm surrounding atmosphere. Skillful mariners are, therefore, persuaded, that a tolerable judgment may be formed of the approach of a ship to this drifting ice, by a proper attention to the coldness and obscurity of the air, in conjunction with a latitude, longitude, and season favourable to the congelation of much water; the ice, too, contains, commonly, a great quantity of light, which, when extricated, and reflected to the mariner's eyes from the clouds, gives warning of its proximity, by a luminous streak nearly as bright as an *Aurora Borealis*.

"It has often been asked, whence this uncommon and prodigious quantity of ice proceeded? There is one circumstance relative to it, rendering it highly probable that it comes from the Arctic Sea, and regions of ever-during frost. The consideration is this; that these immense bodies are veined or streaked with zones or layers of transparent ice, white ice, green and blue ice, sleet and compacted snow, disposed one above another, in such succession, and to such height, as cannot be reasonably supposed to be the accumulation of one winter. They are manifestly the effect of many years congelation. In the course of 10, 20, or perhaps 100, years, or even more, such a composition may be formed, from the ordinary freezing of water below, and from the addition of snow, sleet, and rain, successively above. When such a pile becomes top-heavy, a fragment of it, descending to the adjacent ocean, may form an *ice-island*, if it be solid; or, if softer, or more friable, be spread over a large surface in the form of *field-ice*."

thermometer was at this time ranging from 63° to 65°, the latitude 45°, the longitude 44° 30'.

On the 31st August, 1816, Capt. Gooday, in the ship *Jones*, on his passage from St. Petersburg to New York, in latitude 46° 50', long. 47° 54', saw an island of ice, from about a mile to a mile and a half long, and from 50 to 70 feet high. When first seen it appeared like a white cloud.

In January, 1818, the brig *Anne*, of Poole, W. Dayment master, left the harbour of Greenspond, Newfoundland, in the morning, and, in the evening of the same day, got among ice; proceeded thus about 40 miles, and at day-light next morning was completely beset, and no opening to be seen, in any direction, from the mast-head. In this state the vessel continued for fifteen days, drifting with the ice about 60 miles, S.E. by E., or about four miles in every 24 hours. The ice was now become very heavy, high above the surface, and about twenty large bergs were in sight. With this ice the vessel drove until she was in 44° 37' N. and about 300 miles to the south-eastward of Cape Race, when, on the 17th of February, she got clear through the only opening that appeared in the horizon from East to S.E.; all the rest of the circle forming one compact body of ice as far as the eye could reach. The vessel had been shut in for *twenty-nine* days, in the last fourteen of which she drifted from latitude 46° 57' to latitude 44° 37', about 280 miles, or 20 miles a day, S.E. by E., tremendous gales of wind blowing the whole time from the West to the N.W. In the course of this passage, the master declared that he saw more than 100 large islands of the solid blue ice, known to traders by the name of *Greenland Ice*.

On the 17th day of the same month, January, 1818, the brig *Funchal*, of Greenock, sailed from St. John's, Newfoundland. At about 15 miles to the westward of this port she fell in with a field of ice coming down from the northward, about 8 miles in breadth, and extending to the northward beyond the reach of sight. Having cleared this and proceeded westerly about 250 miles, on the 20th, in latitude 47½° she encountered a still more extensive field, floating to the westward, in the midst of which was an immense iceberg; she cleared this, though not without difficulty, and brought with her a gale of wind, with snow, sleet, and rain, the whole way to Scotland.

On the 6th of May, 1823, the *Mountstone*, of and from Plymouth, was lost on an iceberg, on her passage to Newfoundland. The master and crew, with passengers, in all ten persons, took to the boat without provisions; from which three only of the number were taken by a passing ship, on the 14th of the same month, the remainder having died of hunger!

Our next case is that of the *Ajax*, of Wiscasset, New England, on the passage toward London, March and April, 1826. The following is an extract of a letter from *Wm. S. Shaw*, the commander, to his owners, on the subject. His means of protecting the vessel, under perilous circumstances, are worthy of especial notice.

"On the 12th of March, at 4 a.m., (sea account,) between latitudes 42° and 44° North, weather thick and cloudy, with squalls of hail and snow, we ran the brig in between two reefs of ice, jammed together apparently in a solid mass; the sea being much smoother than usual, which did not alarm us; we knew we were far from land or breakers, until we felt the ice along side of us; as soon as we perceived which, we hove-to until day-light, when we found we were surrounded by a solid body of ice. Around us were thirty icebergs about 150 feet high, and nearly the size of Segwine Island. Finding the ice chafed us badly, we got out fenders. As we had run into the ice before the wind, it was impossible to get out the same way. At sun-rise discovered a narrow opening to leeward, for which we steered under easy sail, and drove her through. We were now in a bay about a mile and a half wide, the reefs on either side, and large cakes of ice in contact with us.

"The wind still blowing fresh at N.W. we kept her before it for about three miles, but could not discover an opening to the southward and westward; tacked, and steered N.E. about 12 miles, it being very difficult to avoid the large cakes of ice that crowded thickly around us.

"Finding there was no opening in this direction, and that the two reefs extended as far as we could see; that there were numerous large islands (of ice) north of us, and an almost innumerable collection of small ones a-head, we concluded, at 10 a.m., to crowd her through the ice; and having prepared fenders of every kind, such as old junk, spars, cord-wood, bales of cotton, and part of one cable, we drifted her into it. We were now in the midst of the ice in a severe gale, accompanied with a thick snow-storm, and had it not been for our precaution in preparing fenders, the ice must have soon made a hole through us. At mid-

day, old Sol deigned to show his brazen face, and laughed at our comical situation. This circumstance enabled us to take an observation, by which we found ourselves in latitude 44 degrees 30 minutes North, and in longitude 43 degrees West, (between the Azores and Newfoundland.)

"As our fenders were nearly destroyed, we were compelled to cut up more of our cable, wooden fenders not sinking deep enough for the purpose of defence under water. You may judge of the difficulty of *crowding* the brig through, by our progress, which was but half a mile an hour, under two reefed topsails, and foresail, the wind blowing heavily. At one o'clock, *p. m.*, we suspended two bales of cotton under our *chains*, that they might not be carried away by rolling against the cakes of ice which we occasionally met, some of which were 100 feet in circumference, and 6 feet thick.

"At one time we were so completely enclosed, that I got out, with part of the crew, and walked on the ice—a walk that few mariners have probably enjoyed at that distance from land on the Western Atlantic Ocean. At eight in the evening, found the surrounding ice much thinner, and the islands less frequent; handed all sails except the close-reefed main-top-sail, which we hove to the mast to keep her from ranging a-head on the islands.

"At day-light, finding ourselves clear from the great body of ice, though not from the islands, we made sail, and steered E.S.E. and E.N.E. for three days, with a good breeze, and under short sail during the night. It was the opinion of all hands, that we sailed *three hundred miles* before we were clear of the large islands of ice!"

In July and August of the same year, 1826, H.M. ship *Ringdove* was on her passage from New York, and fell in with an immense iceberg off the banks of Newfoundland, drifting to the southward, the magnitude and sudden appearance of which astonished every person on board. For the description of an ice-berg seen by Captain J. S. Park, 29th June, 1826, see page 230.

In the month of March, 1828, several vessels arrived at New York, which had fallen in with islands of ice in latitudes 43° to 44°, and longitudes 47° to 49°. This was considered as unusually early in the season for such dangers to be met with. In this season, the brig *Catharine and Hannah*, Capt. Lumsden, which afterward arrived at Cork, picked up, on the 4th of May, in lat. 45° 11', and long. 56° 00', (near *Banque-reau*,) a boat belonging to the *Superb*, of and from Bristol, for Quebec, which ran foul of an ice-berg on the 21st of April, that stove her forward. This unfortunate occurrence obliged all hands to take to the pumps, at which they continued without intermission for two days and a night, when a schooner hove in sight; and the Captain proceeded in the jolly-boat, to treat with them to take the crew. While the Captain was so engaged, the vessel being quite in a sinking state, the crew left the pumps to get the boats out to leave her. They succeeded in getting out a boat, (the one subsequently picked up,) and seven men got into her; upon which they unhooked the tackle, slipped from the ship, but could not regain her, and it coming on thick weather, they could not find the schooner: thus the unfortunate men were left without provisions, water, mast, sail, or any thing that would enable them to struggle for existence, save and except two oars! In this state they were buffeted about for eleven days, when they were fallen in with by the *Catharine and Hannah*. Of the seven men only two were alive; and one of these survived only 24 hours. It is almost superfluous to say, that the only food which they had taken was from the bodies of deceased companions.

Captain Barclay, of the *Brilliant*, for Leith, from Quebec, which he left on the 5th of June, 1829, and narrowly escaped shipwreck, having fallen in with a heavy body of ice, about 20 miles east of the entrance to the Strait of Belle Isle in foggy weather. The icebergs were described by the captain as closer and more numerous than he had ever before seen them in Baffin's Bay or Davis' Strait. The vessel got clear on the 19th of June, after being three days and nights amongst them, and being obliged to proceed a degree and a half to the southward.

On the 11th of May, 1833, between the Outer and Grand Banks of Newfoundland, the brig *Lady of the Lake*, Jn. Grant master, from Belfast, with 230 passengers, in lat. 46° 50', and long. 47° 10', fell in with ice, and while endeavouring to pass between two large pieces, a tongue under water, in the ice, struck the larboard bow, and stove it entirely in. It is not requisite here to repeat an afflicting detail: the consequence was that the brig soon foundered, and only the captain, with fourteen other persons, were ultimately saved.

The *Anne*, from Jamaica, on the 8th of June, 1833, passed four icebergs in latitude 41°,

41°, longitude 49°. Same day spoke the *Mary*, from Havanna, with her bow partially stove, &c., from having been run foul off by the ice.

Lieut. Evans, the intelligent officer to whom we are indebted for a great part of these extracts, says, "There is scarcely a doubt but that most of the vessels from the West-Indies and America, that have been missing, perished in the same manner as the *Mount-stone*; icebergs having been met with some degrees to the southward of the banks of Newfoundland, in June and July. The commanders of vessels, therefore, who have occasion to pass between the parallels of 35 and 50 degrees North, cannot be too cautious: a look-out man should be placed on the fore-yard, during the night, and in foggy or hazy weather, also in the day-time; in addition to these, there should be one on each bow: and during a fog, the fore-sail should be hauled up, especially in crossing the Banks, where icebergs have been met with aground: careful attention, too, should be paid to the thermometer, as experience has shown that it is an indicator of the vicinity of ice. Captain Franklin observes, that the approach to ice would be evidently pointed out in those parts of the Atlantic where the surface is not continually chilled by the passing and melting of ice, as in the Arctic sea; and he strongly recommends a *strict hourly* attention to the *thermometrical state* of the water at the surface, in all parts where ships are exposed to the dangerous concussion of floating icebergs, as a principal means of security. There would be very little trouble attending such a point of duty, yet, we believe there are many masters who would not undergo it, but trust to chance the safety of their vessel, their own lives, and those of their crew and passengers: many have made repeated voyages across the Atlantic, without having seen floating ice, and, therefore, become incautious; it is to these we would particularly recommend the perusal of this paper. The following extract fully corroborates Capt. Franklin's assertion. 'The morning of the 1st August (says Capt. Lyon) was thick and foggy, with rain: at 10 *a. m.* we discovered through the haze, our first piece of ice, a small berg of about 70 feet; we soon passed this and several others, but saw no *floe* or *brash* ice, although there was every reason to suppose that a *pack* was near, from the sudden smoothness and change of temperature in the water, now at 32°, while the air was at only 34°. Repeated observations of this kind have now brought to a certainty the assertion, that, the approach to ice from an open sea, may be ascertained by the sudden change of the thermometer; and, acting from past experience, I caused the most active look-out to be kept, on observing it to fall suddenly this morning; yet this change first took place in a very thick fog, and we ran about ten miles before the ice was seen.'

"Mr. Weddell, an experienced master in the navy, recommends that, with a free side-wind, an ice-berg or ice island should be passed on the windward side; as, by this mean, the loose ice, which always drifts farthest, is avoided."

SHOALS AND VIGIAS IN GENERAL.

On the Shoals and Vigie in these parallels, the following Remarks were made, in 1828, by *Lieut. Evans*, the writer of the preceding remarks on the Ices.*

"Between the Great Bank of Newfoundland and the English Channel, it was found that, whenever we approached toward the *Vigias*, or dangers laid down in the chart, the water changed from the deep blue of the ocean to *green*, (in some instances of a light pea-green,) and this colour was not the effect of any change in the state of the atmosphere, but remained the same under the different alternations of sun-shine, cloudy weather, and haze; and it was noticed that the medusæ, polypi, &c., were infinitely more abundant in these spaces of green water than in those of a blue colour; indeed, very few of the larger species of these animals were observed in the latter: they were generally of the small orbicular kind; whereas, in the green water, they were frequently from 3 to 5 feet in diameter, of an infinite variety of shapes, and of the most brilliant colours."

Many changes of colour in the water may be found where no dangers are known to exist, and of such we consider was that seen by Mr. Cornforth, of the brig *Harbinger*, as shown

* *Lieut. John Evans* (*a*) R.N., is the author of an estimable volume, frequently quoted in the present work, published at Bristol, and entitled "A Revision and Explanation of Terms, Geographic and Hydrographic, including Nautical Terms connected with the Science, copious accounts of the Winds, and the changes which take place in the Atmosphere, &c., illustrated with plates." The work has been allowed to go out of print, but an abridgement of it has appeared, under the title of "A Catechism of Geographical and Hydrographical Terms, for the use of Schools," &c.

in the Nautical Magazine, Dec. 1835. Latitude calculated up from noon, $39^{\circ} 13'$, long. $46^{\circ} 19'$, corroborated by sidereal observations. Weather fine and steady. At 3 h. 15 m. the temperature of the water was 64° , at 3 h. 30 m. and at 4 h. it had risen to $65\frac{1}{2}^{\circ}$. From the mast-head no signs of breakers could be discovered on the line between the light blue water and the dark green, either to the south or north, though the changes of colour were as perceptible as black is from white; ship running seven knots, with studding sails on both sides; but soundings were not taken.

Captain Nockells, in the ship *Brightman*, of London, on his return from Jamaica, in June, 1832, passed through a tract between the parallels of 40° and 43° , longitudes 55° to 40° , and in all this route, (southward and south-eastward of the Grand Bank,) found the water uniformly of a *deep green colour*. With this tint of water he seems to have passed nearly over the track of Lieutenant Sainthill, in 1832, described as the *Beaufort Bank*, in lat. $42^{\circ} 37'$, long. $41^{\circ} 45'$, and noticed in its proper place hereafter.* This subject is again reverted to under the general head of "Soundings and discoloured Water" in the present section.

ROCHE BONNE and the Bancs Vertes, in the Bay of Biscay.

These are two reefs, lying within a short distance of each other, East of the Isle of Re. Their position will be found already noticed, in the description of the coasts, &c. p. 275.

THE CHAPELLE BANK?

In the Analysis of the French chart of the Atlantic, of 1786, it was remarked that a rock, denominated *La Chapelle*, on the chart of 1766, in latitude $47^{\circ} 24'$, and longitude $7^{\circ} 12'$, was said to have been seen in 1764. No information respecting it has since been found, although very particular researches have been made; and it has been given up as imaginary.

But, on the 27th of September, 1822, as the sloop *Favorite* was returning from Malaga toward Liverpool, at day-light, the water appeared green, as if on soundings; at 10 a.m. the water seemed greener, also at noon, when the latitude observed was $47^{\circ} 26' 1''$, and the longitude, by account, from last lunar, $7^{\circ} 41'$.

"28th of September. If we are on soundings, which the water seems to denote, by still getting greener, we must have been on them in the morning, in about $7^{\circ} 24'$ W. longitude, as the watch on deck noticed the colour of the water, so soon as day-light broke. I came on deck, says Captain Livingston, soon after, and immediately remarked it; and the next watch, on coming on deck at 8 a.m., also remarked it. All of us, without its being pointed out, and we have three tolerable navigators, (experienced seamen,) besides myself, on board. At 4 p.m., water much discoloured, and a heavy sea. About 7 p.m., wind abating, and a very cross sea, and one place, in particular, broke, as if on bottom of no great depth. At 7 h. 27 m., latitude, by meridian altitude of the star Altair, a good observation, $47^{\circ} 36' 56''$. By 7 h. 30 m. water suddenly quite smooth, as if under the lee of land. At 8, the temperature of the water was decreasing, and, fearing, (however unlikely,) that we were near the coast of France, altered our course to clear all danger. At 8 p.m., sounded, and got rocky bottom in 65 fathoms: the arming of the lead bringing up a bit of shell and three small black specks. At 8 h. 21 m. again sounded, in the same depth of water, 65 fathoms, and rocky bottom; but this time the arming had only two small specks and a very minute one; made sail, and kept away to clear the land. At midnight, sounded: no bottom at 80 fathoms. At 6 a.m., no appearance of land; hauled up: the day-light increasing, perceive the water is less discoloured; and by noon the water is quite blue again.

"At noon, latitude, by account, $47^{\circ} 49' 38''$, observed, $47^{\circ} 49' 49''$. Longitude, by account, from last lunars, $9^{\circ} 15' 59''$, at noon this day.

"We have really passed over a bank, which may extend, in longitude, from about $7^{\circ} 24'$ to $8^{\circ} 29'$ West of Greenwich: I am aware, however, that this can be considered as a rough guess only; and, from the thermometer, it seems highly probable that some places on the bank are much shoaler than others. At all events, the latitude, in which we got

* The maritime inquirer may perhaps be gratified by turning to a discussion of this subject, written by an *Advocate for the frequent use of the deep sea-lead*, and given in the *Nautical Magazine* of October, 1833.

soundings in 65 fathoms, may fairly and surely be taken at about $47^{\circ} 37' 12''$, being nearly the mean latitude, found by meridian altitudes of * Altair, (*a* Aquilla,) and the ζ , at mean of the times of the two observations, viz., at 8 h. 30 m., when we could hardly have the line hauled in, after the second soundings. Variation allowed on the preceding day's work, about $26\frac{1}{2}^{\circ}$ W.

"The *Chapelle Bank*, as we may call it, will, at any rate, be found, in latitude $47^{\circ} 37'$, somewhere between the meridians of $7^{\circ} 24'$ and $8^{\circ} 29'$. I have not calculated back for its position from the lunar of the 30th, because I am convinced Rennell's Current subsequently gave us westing, equal to all we made, or nearly so, on the edge of Channel soundings. I hope that some person, who has time and good chronometers, will ascertain the true position of the bank, now I have undoubtedly ascertained it to exist."

The French surveyors have since said that the *Chapelle Rock*, which is traced on several old charts, has long been the object of our ineffectual researches. We have found only, in the situation assigned to this rock, an insulated bottom, of small extent, having over it not less than 80 fathoms, and on which the sea may break in rough weather, but have little reason for believing that a danger exists hereabout.

On the 30th of July, 1828, favoured by fine weather, we traversed on the parallel of $47^{\circ} 31'$, at the rate of 3 or 4 knots, the horizon very clear, and the sea smooth. We lost bottom with 180 fathoms in longitude $6^{\circ} 59' 30''$ at three-quarters past three, *a.m.*; and thence continued to sound, in all directions, near the spot where the rock was said to exist. We at first obtained ground with the depth of 103 fathoms, but notwithstanding all our efforts we gained no less than 80, and this was in latitude $47^{\circ} 33' 47''$, and longitude $7^{\circ} 20' 12''$. The position of this sounding may be regarded as very exactly determined by lunar and chronometric observations.

It was remarkable here, that, at several miles to the west of this bank, a portion of a lower mast was found, 20 feet long, covered with long sea-weeds and shells, which, from a distance, appeared like a rock even with the water. The weather was so favourable that, on an approach, the object was found to be really a piece of floating wood; but had the weather been otherwise, so as to have prevented examination, it might have been supposed to be a *vigia*, or rock, even with the water.

DEVIL'S ROCKS, in lat. $46^{\circ} 35'$, and long. $13^{\circ} 7'$.

M. Bellin, in his Memoir of 1742, noticed that, in latitude $46^{\circ} 55'$, about 110 leagues W.S.W. of Ushant, there is a rock even with the surface of the water, discovered by Captain Brignon, of the *Constance*, of St. Malo, in 1737. The *Devil's Rocks*, in lat. $46^{\circ} 35'$, and long. $13^{\circ} 10'$, according to M. Delisle, may be the same danger. These have been marked on many charts. They were particularly observed in 1764, by Captain Thomas, a respectable and intelligent navigator of Havre de Grace, from whose written communication, addressed to M. L'Abbe Diquemare, we find that, on the 23d of May, 1764, Captain Thomas observed at noon the latitude $46^{\circ} 24'$. The danger was discovered at the same moment, off the larboard bow, at a short distance, three feet above water, of a grey colour, covered with moss, and about 40 feet in diameter. We formerly placed it, upon this authority, in latitude $46^{\circ} 24'$: estimating the longitude at about $13^{\circ} 10'$.

In a Liverpool Advertiser of the 5th of July, 1819, a note on these rocks was given as follows:—"The Brothock, of Arbroth, Captain William Peter, on a voyage from this port to Rio Janeiro, on the 13th of November, [1818,] running with a fresh breeze from the N.N.E. at noon, observed a rock about 10 feet from the starboard quarter, about two feet under the surface of the water, in latitude $46^{\circ} 35'$ N., and the longitude, by mean of two well-regulated chronometers, $13^{\circ} 7'$ W. The water recoiled around it, and broke on the top. Its circumference appeared to be about 40 feet. The above rock agrees in latitude with the Devil's Rocks, which have been so long doubtful: its longitude differs a few miles only."

This rock was seen, a few years ago, by Captain Scott, of the cutter *Voast*; and again, at 4 *p.m.*, on the 25th of April, 1829, by Captain Henderson, of the *Fortescue*, from Mauritius to London. The appearance, according to the latter, was that of a rock, of a brown colour, about 12 feet long, nearly as much in breadth, and about two feet above water. The latitude (at 4 *p.m.*) carried on from meridian altitude that day, was $46^{\circ} 33'$, and mean longitude, lunar and chronometric, from observations in the morning, $13^{\circ} 2' 2''$ W. Captain Scott is of opinion that there are more heads of rock than one: that which he saw was like the point of a sugar-loaf.

The Devil's Rocks were seen, in 1829, by Captain Swainson, in the *Fortitude*, of Dublin, and described as in latitude $46^{\circ} 35'$, longitude $13^{\circ} 8'$. They were subsequently sought for and seen by a commander who has said that the water was seen breaking upon them very high, and as it receded the rocks were discernible; "We were going nine knots at the time, and had the wind not been very strong I do not think they would have been observed. In fine weather, I am of opinion, the water would not break upon them. I did not heave-to, when I neared them, to take an observation, but made one soon after, and from the distance we had run, I made them to lie in nearly the same position as that of the *Fortitude*."

On passing this way, in the *Friends*, 17th August, 1820, Capt. Livingston says, At about 2h. 20m. *p. m.* supposed to be certainly to the southward of the *Devil's Rocks*, and looking over the lee quarter, I saw what, at first sight, appeared to be a bottle, about 30 fathoms to leeward. The sea immediately covered it, and on its emerging again, it seemed like the back fin of a shark, in the wash of the sea, about 4 inches above water, and of a triangular form. I sang out, "A shark, and a large one too." To my surprise, it did not seem inclined to follow us in the wake, and we passed it quickly. A few moments afterwards, as I was attempting to point out the place I had seen it in to the mate, he remarked that he saw breakers off the boom-end; and, on paying attention to it, I plainly saw a slight curl and break of the water for fully half a mile; but as the water was very smooth the break was not great, though still plain enough, while no part of the surrounding sea broke. Some time afterward, when the rise of the thermometer in water led us to reason on its cause, and reconsider the circumstances, the result was an impression that we had passed a large and very dangerous shoal, situated in about $46^{\circ} 9' 30''$ N. and $12^{\circ} 50'$ W.*

NEGRE'S ROCKS, lat. $48^{\circ} 7'$, long. $21^{\circ} 0'$?

These rocks, said to have been seen in 1742, have been designedly omitted in the chart, from a conjecture that the back of a whale may have produced the appearance formerly described.

The FIVE HEADS, in lat. $44^{\circ} 15'$, long. $19^{\circ} 25'$?

Under this denomination the French chart of 1766 has a rocky shoal, some part above water, in latitude $44^{\circ} 10'$, and longitude $19^{\circ} 25'$. It is marked some minutes more to the north on the charts of M. Van Keulen. No account of it is, however, given either by him or Bellin: nor, although sought after, has any account of it yet been found. It seems that Bellin, in his charts of 1757 and 1766, has given it on the solitary authority of Van Keulen. We shall erase it from the charts.

ISLE VERTE, or Green Rock, in about $44^{\circ} 52'$ N., and long. $26^{\circ} 25'$ W.

This rock, the '*Green Island*' of the old charts, has been omitted in others, on the authority of Messrs. Verdun and Borda, who have said, "On M. Bellin's chart of 1766, in latitude $44^{\circ} 52'$, and longitude $26^{\circ} 25'$,† is an *imaginary* island, named the Isle Verte

* In the '*United Service Journal*,' October, 1834, (p. 199,) is a lively description of a moon-light night at sea, during a gale, which concludes with that of a dreadful reef, supposed to be the *Devil's Rocks*. The communication is more in the style of a novelist than of a seaman, and there is not a word on the *situation* of the reef. The following are extracts. The time about 11 *p. m.* In a moment the cry of '*breakers*' went through the ship; and so sudden, so unexpected, was the danger of destruction, that hope of safety there was none; the ship was flying through the water; the breakers not more than two cables' length off; not only a-head, but several points on each bow.

The black tops of a reef of rocks were seen, occasionally bared by the reflux of the boiling surf. The ship was in the midst of breakers. Two mighty surges rushed over her deck, and swept away every thing loose into the sea. The reefs, among which she was entangled, appeared to inclose her like a horse-shoe, forming a barrier of foaming surf a-head, and for several points abaft the beam on either side; but, by aid of the powerful moon-light, the captain espied a small spot of dark water to larboard, forming a gap in the line of breakers. We neared the spot fast: it widened as we advanced, and the ship, by excellent seamanship, shot through a channel scarcely half a cable's length in breadth, and between two walls of gigantic breakers.

The reef seemed to extend from N.W. to S.E. in a semi-circular direction; its convex side turned to the East, and presenting, for apparently a distance of three or four miles, a line of tumbling and whitened foam.

The sails being now trimmed, the ship was once more put before the wind, and bounded buoyantly on. The white heads of the breakers grew less and less apparent, and seen only at intervals, whilst the sound of their thundering rush was lost in the hollow moaning of the wind. See, farther, Captain Livingston's communication upon this subject, '*Nautical Magazine*,' Dec. 1834, p. 737.

† Originally $23^{\circ} 45'$, or from Paris.—EDIT.

or Green Island. In the Memoir of 1742, we find nothing concerning this island, but that the 'Isle Verte is marked according to *Le Boccage*.' It appears on the English chart of Jefferys, in latitude 44° 45', and longitude 26° 10', and is supported by no better authority; we cannot, therefore, believe that it exists. A great number of ships pass every year through this latitude and the adjacent parallels, and a thousand authorities would surely attest its existence were it not *imaginary*."

Notwithstanding all this, Captain Tulloch, of New Hampshire, (already mentioned, page 357,) has stated, that an acquaintance of his, Captain Coombs, of the ship *Pallas*, of Bath, in the district of Maine, when crossing, or running down, the parallel in which Green Island is laid down in the charts, and keeping a look-out for it, although he had little idea that it really existed, actually saw it, being on a very fine day, and the water remarkably smooth: he went out in his boat, examined it, and found it to be a large rock or stone, covered with green herbage, or moss, *some of which he pulled off*. The rock did not seem much larger than a vessel with the bottom up, and it was very smooth around. The summit was higher than a vessel's bottom would appear out of the water, being about 20 feet high above the sea. Captain Coombs remarked that, if it had not been so high, he should, when he first saw it, have supposed it to be a vessel which had been upset.

Captain Tulloch considers that Captain Coombs, who is now dead, was a man of perfect veracity. It is to be regretted that we have not yet the exact position of the rock.

(Communicated by Captain Livingston, 1819.)

GREEVE'S LEDGE, in lat. 44° 15', long. 25° 5'.

This is stated to have been seen by the Dutch ship *Anna Catharine*, Captain J. Greeve, July 7, 1745, and to be nearly level with the sea. It is said to have been seen by Captain Currie, of the brig *Diana*, of Port Glasgow, in 1811. Captain Livingston says, "I was informed by one of his crew, (John Hagarty, whose veracity I can depend on,) that they saw it very plainly. It was a rock, about two feet above water, and had sea-weed growing on it. On being asked if it might not be ice? He replied, 'he was perfectly certain that it was not.'" *The position is yet uncertain.*

MIDGLEY SHOAL, in lat. 44° 9' 30", long. 22° 57' 45".

This shoal was discovered by Capt. Thos. Midgley, in 1838, who describes it as follows:—"On the 14th of June, 1838, at 2h. 40m. *p.m.*, on my passage from Africa to Liverpool, I suddenly fell in with a large patch or belt of discoloured water, of a dirty grey appearance, much resembling river water, and *rippling very much*, as if upon a shoal bank. No rock nor danger could be seen from the mast head, but the water appeared very much discoloured for more than half a mile in breadth, as far as the eye could reach, in a direction N.W. and S.E. by compass.

"The vessel passed at a quarter to half a mile from the S.E. point or extremity of it, which lies in latitude 44° 9' 30" N.; long. by an excellent chronometer, 22° 57' 45" W. of Greenwich, and by account from Flores, 23° 5' W. The latitude reduced from the sun's meridian altitude, taken on the same day, with 2 excellent sextants, and the chronometer ascertained to be correct off Flores, four days previously, and subsequently when off Holyhead in St. George's Channel. The altitudes for the time were taken a few minutes after passing the danger, and when it was still within one mile from the vessel.

"In appearance this water very much reminded me of the shoal ground near Nantucket, and those on George's Bank; had it been caused by ice, some would have been seen upon the surface: if by fish, there would have doubtless been many birds hovering about, which was not the case.

"At the time I saw this danger I was running with a favourable breeze and clear weather, and the contrast between the deep blue colour of the water, in which the vessel was sailing, and that of the danger I allude to, was noticed by every one on board.

"This is perhaps the *Greeve's Ledge* of the charts, said to have been seen by Capt. Greeve, of the Dutch ship *Anna Catharine*, in 1745, and since by Capt. Currie, of the *Diana*, of Port Glasgow, and laid down in lat. 44° 15' N. and long. 25° 5' W., the latter probably by dead reckoning.

("I sincerely regret my inability of closely examining the shoal, owing to my crew being on short allowance of provisions and water, in consequence of a long prevalence of light and adverse winds.")

WOODALL'S ROCK, near lat. $45^{\circ} 20'$, long. $25^{\circ} 10'$.

"Ship *Indemnity*, at sea, on her way from Demerary to England, 1829, at 30m. *p. m.* discovered a rock on her starboard beam, distant about three ships' lengths; the ship was then going at the rate of about two and a half miles an hour, with a heavy swell from the N.W. With each succeeding swell the rock was entirely covered, but at intervals it showed several feet above water, and perfectly perpendicular. From the mast-head it was seen to a great depth below the water, and appeared to be in the shape of a cone. At the preceding noon the latitude, by observation, was $43^{\circ} 20'$ N., and longitude, by chronometer, $25^{\circ} 10'$ W." (*Attested by the Captain, Mate, and passengers.*)

AMPLIMONT ROCKS, in lat. $42^{\circ} 30'$, long. $24^{\circ} 5'$.

In M. Bellin's Memoir, of 1742, a danger is mentioned in latitude $42^{\circ} 30'$, and longitude $24^{\circ} 5'$, which was seen in 1735 by M. Guichardi, commander of the ship *Dauphin*, of Nantes. It has two points of rocks, separated, and 30 feet above water. He ascertained the height within a league of the danger, which appears to be the same as that called *La Basse d'Amplimont*, stated to be nearly in the same latitude and longitude.—We have given it the position originally assigned by the Memoir. Some Englishman has called it by the name of *Edmund Knowles's Rock*, by whom it is supposed to have been seen.

These rocks, appearing like the two masts of a brig, and nearly in the position assigned, were seen by Captain Mills, in the brig *Tamer*, early in 1829.

THE THREE CHIMNEYS, in lat. $47^{\circ} 54'$, long. $29^{\circ} 40'$.

This vigia is said to have been seen on the 10th July, 1729, by Captain de Clas Fernel, who approached within two leagues of it; and who remained two hours in sight of it. This vigia appears to be one which a M. de Merry has mentioned. The charts vary with regard to its position, and its existence may even be considered as very doubtful.

Thus much we have stated in our former editions: but Mr. Heron, of Greenock, in 1824, adds, "I am informed by the master of a merchant-vessel, that the Chimneys actually exist, for a whole watch as well as himself saw them. They were seen about twilight, and three heads were distinguished. From an observation taken at the preceding noon, it was inferred, that their latitude, as laid down on the chart, is very near the truth."

GOUGH'S ROCKS, in lat. $40^{\circ} 28'$, and long. $30^{\circ} 0'$.

These rocks appeared in the chart of M. Rochette, 1778, with the words, "Rocks seen by Captains Gough and Birch." This reef may possibly be the shoal next described. Vankeulen and Bellin have indicated several dangers in the vicinity to the N.E., but their existence has been denied by the pilots of the Azores.

Captain Livingston says, "Captain Beauford, of the brig *Concord*, of North-Yarmouth, told me at Malaga, in 1820, that he twice saw Gough and Birch's Rocks, when bound from Newfoundland to Lisbon. That one of them is about 12, and the other 3, feet above water; and that they lie nearly in the longitude originally assigned them in the charts, but five minutes more to the northward."

Another report states that Gough's Rocks were seen by Captain Harrison, in the brig *Hope*, from Sierra Leon to Cork, 17th April, 1830, latitude $40^{\circ} 16'$, long. 33° . At 11 *a. m.* two rocks appeared close under the lee-quarter. In smooth water these rocks would be even with the water's edge, and in the hollow of the sea Captain H. could distinctly see six or eight down in the water.

JAQUET ISLAND, in lat. $46^{\circ} 55'$, and long. $39^{\circ} 30'$?

The existence of this island has been so much doubted, that it has been omitted in several modern charts: but, having been stated to have been seen in 1789, it has been restored.

A letter from Jersey 3rd of April, 1838, states that *Jaquet Isle*, in about $46^{\circ} 55'$ N. and long. $39^{\circ} 29'$ W., was seen by the brig *Sea-flower*, of Jersey, at 5 *a. m.*, on the 25th of April, 1836: the weather fine and clear. On seeing the isle the vessel hove-to and sounded, but no bottom was found at 100 fathoms. The isle appeared to be half a mile in length, and about 300 feet or 100 yards high above the surface of the sea. Rocks may be seen extending a cable's length from the S.S.E. end, which appears to be the highest land, with a vast number of birds, such as are seen on the Banks of Newfoundland. By the ship's

ship's course and distance run from 6 *a. m.* to noon, the isle is estimated to lie in the position above expressed.

Mr. Le Gros, mate of the *Sea-flower*, who sketched the appearance of the isle when it bore between E.N.E. $\frac{3}{4}$ E. and E. $\frac{1}{4}$ S. (by compass) declares that it is *not* an iceberg, as commonly supposed. Lat. at noon, $46^{\circ} 50'$; course after 6 *a. m.* to noon, W.N.W. [*W. $\frac{1}{4}$ S. true,*] 48 miles. Ship's long. at noon, by reckoning, having no chronometer, about $40^{\circ} 41'$ W. Here may be added, that doubts, previously entertained, have not entirely vanished.

BEAUFORT BANK, lat. $42^{\circ} 37'$, long. $41^{\circ} 45'$.

Lieut. A. Sainthill, R.N., commander of the ship *Beaufort*, on returning from Jamaica, August 3, 1832, when in latitude $42^{\circ} 37'$, and long. $41^{\circ} 45'$, observed the water to be discoloured; in consequence of which he twice tried for soundings, and found rocky ground at the depth of 100 fathoms. Lieut. Sainthill is of opinion that soundings might be found from the meridian of 20° West to the Banks of Newfoundland. See, upon this subject, the *Nautical Magazine*, Oct. 1832, page 393, and October, 1833, page 599.

DRUID'S REEF, in lat. $41^{\circ} 19'$, and long. $41^{\circ} 25'$.

On the 12th of April, 1831, Capt. Treadwell, in the *Druid*, of London, passed this reef on his starboard hand, at not more than 30 yards distant. The weather was calm, and he had taken a good meridian altitude, whence the latitude was assumed as above, with the longitude by a chronometer, which has always proved correct. The reef had the appearance of from seven to ten sugar-loaf heads, and its length from E.N.E. to W.S.W. was estimated at 10 to 14 feet. It was about 3 feet above water.

The reef was heretofore inserted from the late Spanish chart, as seen in 1803, lat. $41^{\circ} 24'$, and long. $41^{\circ} 20'$; but we are not acquainted with the authority under which it has been there introduced. It may possibly be a rock, said to be seen by Desmaries, a pilot, in 1683, who reported that it appeared at the height of a sloop above the water. Bellin assigned to this danger lat. $42^{\circ} 0'$, and long. $41^{\circ} 10'$. The Spanish chart also exhibits another *vigia*, said to have been seen in 1798, lat. $43^{\circ} 30'$, long. $37^{\circ} 35'$. Most likely to be of ice only.

HERVAGAUT'S BREAKERS, in lat. $41^{\circ} 2'$, and long. $49^{\circ} 23'$.

We have shown the situation of these breakers on the chart, although it has been the opinion of many experienced navigators that no danger exists here; and that masses of ice, seen in these places, have been mistaken for rocks. They were inserted originally upon the authority of M. Hervagault, commander of *Le Conquerant*, of Nantes, 26th of June, 1723; who described them as composed of two parts, between which he was forced to pass; being, when he first perceived them, at a cable's length from the one, and not more than an eighth of a league from the other. The sea between was very clear, and broke heavily upon the dangers. In a manuscript at the French *Depôt Marine*, there are these additional particulars: "The shoal, within a cable's length of which he passed, is a rock, which showed itself after the sea had broken upon it. On the other danger the sea broke in three different places, and between each it appeared very clear."

Again, on the 12th of May, 1827, Captain Maxwell, of the ship *Home*, on his passage from Liverpool to New York, fell in with three sunken rocks, with a tremendous sea breaking on them, apparently from four to six feet under the surface, in latitude $41^{\circ} 2'$ North, and longitude $49^{\circ} 23'$ West, and about 30 feet in circumference, the last of them tailed off to the north-eastward with a long ledge. Captain Maxwell says, "I would have sounded immediately, but being just dusk, and the ship under a press of canvas, prevented me. The air at the time was 63° , and one hour before we perceived the danger, I tried the thermometer at the depth of two fathoms, and found it to be 45° ; an hour afterwards I tried again, and found it 60° . The above information I have conceived it my duty to give you, being aware that many of my seafaring brothers must have suffered on this fatal spot; although from the first of these rocks to the last, was within one mile. Winds, at the time, W.S.W., ship's head N.W., going $7\frac{1}{2}$ knots per hour. The chronometer I have with me can be depended upon to one mile, and the latitude and longitude I have given is correct." This shoal is the Hervagault's Breakers of the French charts. In 1816, it was seen by Captain Lourp, of the brig *Alexander Savage*, who places it in latitude $41^{\circ} 6' 23''$ N., and longitude, by dead reckoning, $49^{\circ} 57'$. We, of course, adopt the situation assigned by Captain Maxwell.

DARAITH'S ROCK, in lat. $40^{\circ} 50'$, and long. $54^{\circ} 53'$?

The same opinion has been entertained of this as of Hervagault's breakers. M. Bellin, however, placed it as a certain danger; and, in his Memoir of 1742, has said that, this danger was seen on the 22d of August, 1700, by M. Daraith, who approached within a league and a half of it, then sailed around it, in order to observe it well, and took an altitude within sight of it. The rock is described as extending a league and a half, being three-quarters of a league broad. Its longitude is very uncertain.

WATSON'S ROCK, lat. $40^{\circ} 18'$, and long. $53^{\circ} 40'$?

Extract of a letter from Captain T. A. Watson, of the *Harbinger*, dated Liverpool, 22d July, 1824.

"Perhaps you may have seen, in some of the newspapers, a notice respecting a rock seen by me in April last, on my passage from this port (Liverpool) to St. John's, N. B. The following are the particulars:—April 20th, at 8 a.m., being on the starboard tack, ship going $2\frac{1}{2}$ knots an hour, moderate weather, a man saw something a-head: the helm was immediately ordered a-weather to clear it, being very near it, ship was only 15 or 20 fathoms to leeward of it, which enabled me to distinctly make it out to be a rock just even with the water; its head was round, and appeared to be about three fathoms or more in diameter; it was covered with weed, similar to that on half-tide rocks, it was of a light green, with some branches of a red colour. It was at times, on the top of a sea, invisible; but, in the hollow of a sea, several feet uncovered. I observed the sea to break on it twice, causing a spray, as any pinnacle-like substance, with deep water around it, might be expected to do. My first officer and others also saw it, and are fully convinced of its being a danger; the lead was hove as soon as it could be got forward, but there was no bottom at 90 fathoms perpendicular. I might then be within musket-shot of it; from the mast-head, no appearance of other danger could be seen.

"From an excellent observation at noon, I consider it to lie in latitude $40^{\circ} 18'$ N. longitude, by dead reckoning, $53^{\circ} 40'$ W.

"The water for several miles around it was dark, as if on soundings. Fearing I might strike on some invisible danger, I did not put the ship's head toward it, and there was too much sea to lower a boat; recovering from the consternation this unexpected sight put me into, I left it astern, fearing there might be more beneath the surface, directly in the track I was going.

"From my thermometrical observations on approaching to, and on the great Bank of Newfoundland, I have reason to think the above longitude nearly correct; at least, if any error, it could be only a few miles too far eastward. I unfortunately broke this *most valuable* instrument a short time before seeing the above danger.

"I understand there have been many opinions as to the truth of my statement; it is difficult to convince some, and perhaps, if the *Harbinger*, which I commanded, had struck on it, some would have supposed she had alighted on the back of a whale, though, by the bye, weeds are seldom seen growing there.

"During the many years (14) I have commanded a ship, mostly in the North American trade, I have seen various things in the ocean, and was too well acquainted to mistrust my eyes in this case. It is said that Daraith saw a danger not far from this, perhaps it may be a part of the same, as he represented it as very extensive; I am convinced, we too often treat *doubtful dangers* in charts with indifference, because they are not always seen by those who look for them; may it not be the case, that ships sometimes are wrecked on them and never heard of! However, I shall always dread the above danger when sailing in that part of the ocean."

The VIRGIN ROCKS, to the E. by S. of Cape Race; lat. $46^{\circ} 26' 30''$, and long. $50^{\circ} 51' 30''$.

These rocks form a dangerous reef, lying about 30 leagues *E. by S. true*, from Cape Race; in gales of wind a heavy sea breaks over them; and a strong current which sets about them, often increases the danger.

The existence of the Virgin Rocks having been questioned, it is proper to communicate the following extract of a letter, addressed by Arthur Kemp, master of the brig *Indiana*, of Dartmouth, to the publisher of the *Newfoundland Gazette*:—"On the 23d of October, 1823, at noon, I left Cape Broyle, after a strong gale from S.E., with the wind at W.N.W. steering

steering S.E. by S. The following morning, at 8 a.m. having run 84 miles, I was alarmed with the cry of 'breakers a-head,' and almost immediately saw them to such an alarming extent, as obliged me to alter the course from S.E. by S. to E. by N., it not being possible to clear them on the other tack. After giving the breakers a good berth, and leaving them to the southward, distant four miles, I hove the main top-sail to the mast, and lay by from 10 o'clock till noon, and observed in latitude 46° 35', longitude 50° 51'; the extent of breakers appeared to be about two miles, and were more tremendously alarming than I have ever experienced, during twenty-three years that I have (chiefly in this trade) commanded a vessel."

The reef has since been surveyed by Mr. Rose, master of H.M.S. *Tyne*, who, with Captain Bishop, of H.M. brig *Manly*, has ascertained its situation. The following are the particulars.

The bank in which the shoal is situated extends E. by N. and W. by S. 4¼ miles; its broadest part is about 2¾ miles. The soundings are regular from 28 to 30 fathoms, until they deepen suddenly on the outer edge to 39 and 43.

The rocks themselves are in 46° 26' 30" N., and 50° 51' 30" W. They extend in an irregular chain, S.W. by W. and N.E. by E. 800 yards, varying from 200 to 300 yards in breadth. The least depth of water is on a white rock, in 4½ fathoms, with 5 to 6½ fathoms all round it; the bottom distinctly visible. Toward the extremities of the shoal are several detached rocks of from 7 to 9 fathoms, with deep water between, and with a current setting over them W.S.W. one mile an hour; and with also a very confused heavy swell.

The vessels were anchored upon the rocks for the space of two days, during which the weather was extremely pleasant, and every way favourable for taking the most accurate observations. Variation 26° 30' W.

A copious detail relative to the reef is given in the *Nautical Magazine*, No. I., page 10; and it is there noticed that the longitude of the rocks, assuming Halifax dock-yard in 63° 38' 41", is 50° 56' 35", but if our longitude of Halifax be correct (63° 33' 40", see p. 55,) the longitude will be only 50° 51' 34"; and in the chart of the rocks it is stated as 50° 51' 30", although laid down in 50° 56½'. The surrounding bank has been noted as a good fishery.

ROCK in the BAY of FUNDY.

A Rock, on which several ships have struck, well known to the regular traders, and seen by Captain Johnstone, of the ship *Liverpool*, trading to St. John's, in 1834. Several vessels have struck on it, and it lies West 3½ miles from the Machias Seal Isle Light.

CASHE'S LEDGE, in lat. 43° 1', and long. 69° 9'.

This is a dangerous reef, about half a mile in extent each way. Its soundings are very irregular, having from 10 to 4 fathoms in the length of a boat. There are 17 fathoms within a cable's length of it, deepening at a short distance to 90 fathoms, on the western side. On approaching the shoal, you may find 60 to 35 fathoms, brown sand, with black stones and broken shells; then 30 fathoms where it becomes rocky. The currents on the ledge are exceedingly rapid and devious. On the shoalest part there are said to be only 12 feet at low water. By observations made, on four successive days, by the master of his Majesty's sloop *Beaver*, the latitude is 43° 1' 0". The longitude has been deduced from that of Cape Anne as from 69° 6' to 69° 12'. For a further description, see our Sailing Directory for Newfoundland, &c., page 151.

SHOAL GROUNDS ON GEORGE'S BANK.

These shoals were formerly described under the respective names of *Brown's Bank* and the *Malabar Shoal*, by neither of which names are they now recognized. A copy of the report of an actual Survey of them, made under the orders of Commodore Isaac Hull, by Mr. Felch, of the U. S. Navy, and Mr. Edmund Blunt, jun., is contained in the *Colombian Navigator*, Vol. I. p. 56. From this report it appears that there are, properly, four shoals on the Bank, the whole of them included between latitudes 41° 34' N. and 41° 53' 30" N., and longitude 67° 18' W. and 67° 59' W. The largest, which is toward the S.W., is, also, the most dangerous. Between the shoals are from 15 to 35 fathoms of water.

But these shoals have since been accurately surveyed by Captain Chas. Wilkes, of the U. S. Navy, and the officers under his direction; as shown by the chart, on a large scale, published by order of the Navy Commissioners in 1837.

It appears by this survey that the general direction of the shoal ground is N.W. by N. and S.E. by S., and it extends 13 miles in length and from one to two miles in width; the depth of water within this space being 10 fathoms and less, but very irregular. The two shoalest places are between $41^{\circ} 40' 13''$ and $41^{\circ} 40' 33''$ N. and $67^{\circ} 44' 10''$ and $67^{\circ} 40' 30''$ W., and are knolls of hard sand, having upon them, at low tide, 15 feet of water. With the exception of these two places, the shoal may be crossed in any part by an ordinary sized vessel without danger. There is a rip usually the whole length of the shoal, and at times heavy breakers on the shoalest places.

A comparison of the latter with the former description affords strong reasons for supposing that the shoals are continually in a shifting state. See note 17, Col. Nav. 1839, p. xxiii.

NANTUCKET SHOALS, extending from Nantucket Island.

These very dangerous shoals have been represented as extending nearly half a degree to the southward from the S.E. end of Nantucket Island: but it has been found, by a late survey, made at the expense of Mr. E. M. Blunt, of New York, that they are by no means so extensive as they have heretofore been represented; and that the southern extremity, with 9 fathoms of water, is in about $40^{\circ} 57'$ N., and $69^{\circ} 58'$ W. For further particulars, see *Colombian Navigator*, Vol. I. p. 73.

But subsequent observations, made by Captain Thomas Pearce, in the ship *General Hamilton*, tend to show that the shoal may extend more to the southward. At 6 a.m. on the 21st of April, 1828, Captain Pearce "sounded in 30 fathoms, steering W.N.W. 4 knots, wind N.N.E. and pleasant. At 8, saw breakers bearing N.W. by N. from mast-head; at half-past 8, sounded in 18 fathoms, breakers then in sight from the deck; at 9, steered West; and at 10, the breakers bore North, distant about one league. In passing to the southward of the shoal had 9, 10, 8, 7, fathoms, for the distance of about one league, then gradually deepened; no land in sight from the royal mast-head. After passing the shoal, steered W. by N. 3 leagues, until noon, and observed in latitude $40^{\circ} 49'$, which will make the shoal in $40^{\circ} 51'$, allowing the ship to have one mile of nothing after passing it. We then steered W.N.W. two leagues, until 4 o'clock, and sounded in 22 fathoms, soft bottom. Steered N.W. by W. 3 leagues until 6 o'clock, and then saw the Vineyard from the topsail-yard bearing N.W. by N. At 8, made Gay Head Light, bearing N.N.W.

"The weather was perfectly clear all day. Much pains taken in the observations, with good instruments, well adjusted."

IMAGINARY SHOALS,

between the parallels of 40° and 50° , formerly described, but now omitted from a conviction of their non-existence.

Land of Bus, sunken, near 58° N. and 33° W.; *Negres' Rocks*, lat. $48^{\circ} 7'$, long. 21° W.; *Mayda*, lat. $46^{\circ} 10'$, long. $19^{\circ} 40'$; *Ramigeau's Vigia*, lat. $42^{\circ} 42'$, long. $37^{\circ} 30'$; *Barencthy's Rock*, lat. $45^{\circ} 33'$, long. $37^{\circ} 25'$.

BETWEEN THE LATITUDES OF 30 AND 40 DEGREES;

DÆDALUS ROCK, off Cape St. Vincent, in about $36^{\circ} 30'$ N. and $9^{\circ} 16'$ W.

The old charts of the Atlantic indicated a danger at the distance of 12 or 15 leagues to the S.W. of Cape St. Vincent. This danger was omitted in the French chart of 1786, and subsequently in other charts, from the supposition that, if it really existed, it must have received some modern confirmation. But it seems, from information communicated by Captain Taylor, of the brig *Laurel*, of Whitby, that, in about 1813, the *Dædalus*, transport, struck on the rock, and received so much damage, as rendered it necessary for her to put into Lisbon for repairs.—Captain Taylor was in the fleet when the *Dædalus* struck.

Added to this, the brig *Briton*, Captain Stokes, was lost, in consequence of striking upon the rock, in December, 1821. After she struck, she swung off, and then immediately tried for soundings, but got none. On finding the vessel sinking, the people took to the boat, and were picked up by another vessel. Captain Stokes had not seen Cape St. Vincent, but supposed it, at the time, to bear N.N.E. $\frac{1}{2}$ E. 28 or 30 miles. This information has been communicated by Captain Livingston, who says, "This information was given to me in Malaga, in September, 1822, by Captain T. Tankersly, of the schooner *Lord Mulgrave*, of London. Captain T. added, that he had met with another master, (name forgotten,) who said

said he had observed the sea-weed on this rock ; got out of his boat, and held on by some of the weed. He supposed the rock to be about 50 yards in circumference."

The preceding information is from Captain Livingston, who also says, " I was some years since informed by an old man of colour, a native of Goa, who was steward of a vessel I then commanded, that, while he was cabin-steward to Sir Edward Pellew, while captain of H.M. ship *Indefatigable*, she struck on a rock off *Cape Finisterre*. This, I understand, has been denied, and it appears truly ; for I have now information on which I can rely, from a very respectable naval officer, whose name I do not consider myself at liberty to mention, that the *Indefatigable*, when commanded by Sir Edward Pellew, actually struck on the rock, or a rock, off *Cape St. Vincent*, and received some damage. I had no doubt, before, that she had struck somewhere, as I had a perfect confidence in my old steward's veracity : the error was in memory only." (*Letter, 28th Oct. 1822.*)

The existence of this rock was confirmed on the 6th of March, 1839, by Mr. John Aves, commander of the schooner *Tantivy*, of Plymouth. At 9 h. 30 m. *p. m.* this vessel, on her voyage from Zante, passed close to the eastward of it ; it was not seen till close aboard, and not avoided without difficulty. There was a swell from the N.W. breaking over it, and a sheet of foam, about 20 to 25 fathoms in circumference. The *Tantivy* stood in N.N.E. on the starboard tack, till 7 next morning, then tacked to the southward, passing the cape at the distance of about two miles. The rock was thus estimated to lie considerably to the eastward of its position as shown by chart, and to bear about S.S.W. true, 37 or 40 miles from the cape.

CLEVELAND REEF, off Cape Ghir or Geer ?

This reef, or bank, said to have been discovered by Captain Cleveland, R.N., in 1765, in latitude 35° 45', at about nine leagues from the coast, was diligently sought for by the *Ætna* and *Raven*, on survey, in 1835, without success ; and it has been accordingly erased from the charts.

FALCON ROCKS, to the northward of Porto Santo.

The situation of these rocks has been already given in the description of the Madeiras, page 372. They had previously been vaguely and erroneously described as a bank, on which Francis Doublet, of Honfleur, grounded, to the N.E. of Porto Santo ; and as a ledge, on which a Dutch ship was lost.

THE EIGHT STONES, to the northward of Madeira ?

A very extensive and dangerous reef, according to M. D'Après, was discovered by a Captain Vobonne, of London, in 1732, and subsequently seen by a vessel going to the West-Indies. Eight rocks were said to be seen, even with the surface of the water, and situate between 34° 30' and 34° 45' N. near the meridian of 16° 40' W. This object has, therefore, for a century past, been alarming to the navigator ; but sufficient evidence, we think, has been given to prove its non-existence.

Independent of the opinions of several mercantile friends, the routes of the following ships and vessels of the British navy seem conclusive. On the East and N.E. of the assumed position we find, in 1828, the Southampton and Chanticleer ; in 1829, the Blossom ; in 1832 the Beagle ; in 1833 the *Ætna* and *Raven* ; more to the west, beyond the meridian of 16°, in 1825, the Martin, and in 1828 the Emulous ; beyond these, westward, the *Raven* and Sulphur, in 1836 ; and the Blossom, in 1825, which passed from the northward directly over the spot. In 1831 the *Ætna* likewise passed over it, and pursued her course thence toward Porto Santo. The *Ætna* again, in 1836, more to the west, sounded near the meridian of 17°, but found no bottom at 200 fathoms. The same ship, in 1833, passed in an east and west direction directly over the supposed centre of the shoal, but found no bottom at 70 fathoms.

These particulars we have gained from a small chart, exhibiting the different routes, which was given in the *Nautical Magazine* of July, 1837.

Captain Fitz-roy says, On the 3rd of January (1832), we were occupied in looking for the 'Eight Stones ;' but nothing was seen to indicate either rocks or shoals or even shallow water. The sun was shining brightly on a deep blue sea, of one uniform colour ; no soundings could be obtained ; and had there been a shoal or rock within seven miles of us at any hour of that day, it could not have been passed unnoticed. So many vessels have searched, in vain, for this alleged groupe of rocks, that their existence can now hardly be thought possible. *Voyage, Vol. II., 46.*

JEAN HAMON'S ROCK, in lat. $36^{\circ} 54'$, and long. $19^{\circ} 49'$?

The existence of this danger rests solely on the authority of Jean Hamon, commander of the *Trois Amis*, of Bordeaux. On the 8th of January, 1733, according to M. Bellin, he approached it within three-quarters of a league, and carefully observed it. He calculated its position by the course and distance run from the discovery of it until his arrival at the Rock of Lisbon, which he made to have been E. by N. *true*, about 165 leagues. The late Captain Goodall, a gentleman long and well acquainted with the navigation of this part of the ocean, informed us, that he did not believe the danger to exist, and we are of opinion that it may safely be obliterated.

WHALE ROCK, in about lat. $38^{\circ} 46'$, long. 25° ?

M. Fleurieu exhibited this rock on his chart of the Azores, at about 29 leagues from St. Michael's, upon the report of a pilot, whom he knew at Angra, in Terceira. Its existence has, however, been disputed. The breakers shown on the chart, which were very high, were seen by Mr. R. Gradun, commander of the ship *Harmony*, of London, on the 8th of January, 1809: their latitude, by observation, being $38^{\circ} 46'$: and longitude, by account, $24^{\circ} 47'$. This affords reason for believing that the rock exists; the situation assigned by Mr. Gradun being very near that stated by M. Fleurieu.

Mr. Reid, late British consul-general at the Azores, believed it really to exist; several masters of vessels, who have been blown to sea from St. Michael's, having told him that they have actually seen it, and that in form it much *resembles a whale*. The Rock has lately been diligently sought for, under an order of the British Admiralty, but without success; and it now seems clear that it cannot lie in the situation assigned by Mr. Gradun; yet it is still believed to exist not far off.

Captain Livingston says that, "While at Malaga, in September, 1821, Captain Finlayson, of the Duke of York schooner, of Portsmouth, informed me that some years since, when Captain Bartholomew, R.N., was at St. Michael's, about the time he was sent by the Admiralty in search of the Whale Rock, the *Nautilus* schooner, of Plymouth, arrived at St. Michael's. After Captain Bartholomew's departure, the commander of that vessel told Capt. F. that, on his passage out, having a chronometer, he remarked to his mate that if the Whale Rock existed in the situation assigned to it, they must pass near it. Accordingly, in the mate's watch that night, the vessel ran through a very heavy break, which alarmed them much; but, before they had time to take any precautionary measures, the vessel was again out of the broken water, and the captain believed they had passed close to the Whale Rock. No person about Angra seems to doubt its actual existence; and one man, I understand, gives a very distinct account of its appearance and situation; having, when he saw it, carefully noted particulars in his journal; he is an Irishman, mate of a trading vessel between Angra and Lisbon, but unfortunately was not at Angra, when I was there. The last time Capt. Bartholomew was at Angra, this man was introduced to him, and stated, on being shown Captain B.'s former tracks in search of it, on the Admiralty Chart, that he never had been near its actual position.

It seems generally believed at Angra, that actually two heads of rock are occasionally seen above water, and it is even reported, that a vessel once passed betwixt them.

TULLOCH REEF, in about $37^{\circ} 27'$ N., and $24^{\circ} 45'$ W.

This reef was discovered, in 1808, by Captain Wm. Tulloch, of the brig *Equator*, of Portsmouth, New Hampshire, on a voyage from Madeira to St. Michael's, as already shown and described in page 357.

It may be remarked that Captain Tulloch observed, from their black cindery appearance, that the rocks had arisen from volcanic impulse; and it is, therefore, possible, that they may have disappeared.

ST. MARY'S BANK, to the S.W. of the Island of St. Mary, in about $35^{\circ} 53'$ N. and $27^{\circ} 19'$ W.

"On our passage, in 1819, from Havanna to Barcelona, we passed over white water, apparently a shoal, to the southward and westward of St. Mary's: the captain would not allow the vessel to heave-to, in order to sound; but I have no doubt in my mind of its being a very extensive bank of soundings; and I have little doubt that I have ascertained its position tolerably accurate from lunars, prior and subsequent. I should not be surprised if it turned out that the bank we passed over was connected with the *Kutusoff Bank*, marked

marked in the last edition of Admiral Espinosa's chart, as having been seen in 1816, and which lies to the S.W. of the one we passed over, at the distance of about a degree. We were some hours crossing the bank.

"The Bank lies in latitude 35° 53' N., as calculated, by account, between the observations of the noon before and noon following; longitude, 27° 19' West of Greenwich, calculated from lunars taken two days before and three days after, connected by account. I have heard a French gentleman, a Lieut. de Vaisseau, mention what I suppose to be the same, at the Table d'Hôte, at St. Michael's, in October, 1818.

"I am of opinion that this bank, when better known, may be of use to vessels coming across, for determining their position by; and it is to be hoped that some of his Majesty's vessels will survey it; for, however much the master of a merchantman may be inclined to do so, he must not delay his vessel.

Andr. Livingston."

JOSYNA ROCK, in lat. 31° 40' and long. 23° 45'?

On this danger it has been stated that the Josyna, of Flushing, was lost in August, 1697. The latitude observed, and the distance 110 leagues from Madeira. In the last Spanish chart, it is said to have been seen in the year 1805. This places it in latitude 31° 40', longitude 23° 45', as above, the position in which it will be found in the chart.

CANDLER'S ROCK, in about 39° 47' N. and 34° 29' W.?

This rock, to the westward of Flores, said to have been seen, a few years ago, by Captain Candler, of the Betsey, of Boston, who thought it to be 100 feet in height, is now believed to have been an ice-berg only, and, therefore, to be expunged from the charts.

CHANTEREAU'S SHOAL, in lat. 38° 16', and long. 39° 49'.

This shoal, which has been described as a white rock, was seen by Captain Chantereau, of the ship *L'Auguste*, in coming from Martinique, 6th September, 1721, when the sea broke on it very much. It was again seen by Lieut. Edm. Scott, commanding the *Princess Elizabeth* packet, 24th of April, 1828, and that gentleman has given the following account of it. "On the 24th of April, 1828, at 3 p. m., I came on deck, and immediately observed the water round the ship very green, and with every appearance of being in soundings; and, on looking before the starboard beam, saw under water, at the distance of two cables, what evidently appeared, to the master and myself, to be a white sand-bank or rock, which the water did not then break on, but it appeared so very plain that there could not be much water on it. In extent it was about one or one and a half cable E. by N. and W. by S. true, and about half a cable in breadth."

Immediately on observing the shoal, I ordered the lead and line up; but, ere it was ready, the colour of the water had changed to a deep sea-blue, when it was evidently useless to sound; at that time we were about a mile from the white spot; we had, at the time, a good breeze, but very little swell of the sea. I obtained two sets of lunar distances the day before; and at noon on the 23rd had taken myself, with a sextant, the meridian altitude *very particularly*, in order to obtain the time correctly for lunar distances, on the opposite side to those previously taken, and which I did obtain, and made the latitude of the shoal 38° 16' N., and by the mean of the lunars, which differed very little, 39° 48' 49" W. Owing to a defect in my chronometer, I was not enabled to bring forward the longitude by it, but every care and attention in my power has been taken to give its correct situation."

BRETON'S ROCK, about lat. 39° 40', and long. 41° 35'.

This shoal, according to M. Bellin, was seen by Breton, a pilot of Rochelle, who marked it merely as a rock. Laisné, another pilot, has also placed it in nearly the same latitude and longitude. It may be the same as that which Roland, a pilot of Tremblade, sounded; and also seen by Jean Desmaries; there being scarcely 10 minutes difference in latitude, and, in longitude, not more than a degree. The situation originally assigned was 39° 45' N., and 41° 25' W.

This danger was again seen, in 1816, by the ship *Tiger*, on her passage from Barbadoes to Liverpool. The letter of a passenger states that, "On the 14th of March, at 10 a. m., a smart breeze from the S.W., with studding-sails set, going seven knots and a half an hour, steering E. by N., true, in lat. 39° 40', long. 41° 40', we passed over a very agitated rumbling sea. Under our starboard bow, in appearance about a circle of a mile, was a small field of dark brown rock-weed, apparently a confirmed fixture: entangled with the

weed were two pieces of spar, seemingly very much decayed. I am positive that this is a danger which ought to be carefully avoided by all ships coming to Europe from the West-Indies and America, as it lies directly in the track." (*Newspaper*, April 15, 1816.)

We are still at a loss for the position of the shoal ; as it does not appear to have yet been correctly ascertained.

MUNN'S REEF, in about 39° N. and $64^{\circ} 20'$ W. ?

This shoal was seen by the brig *Joseph Hume*, of which Mr. Alex. Munn was mate, 22d of August, 1827, on her passage homeward to Liverpool. "The vessel passed close to it, they saw the white sand above the water, and sounding where the vessel then was, found 20 fathoms, sandy bottom, a quarter of a mile off : then bore up and sailed westward of it, in deep water."

The master would not allow the mate to examine the shoal ; but from the brig's mast-head the latter observed it to be of a horse-shoe form, the opening of the shoe facing the S.W., and it appeared in length to be not more than half or three-quarters of a mile, on the southern edge of the Florida-Stream.

This information was communicated by Mr. Munn, through the medium of Captain James Porter, of the bark *Science*, of Greenock. The position of the shoal, by *observation*, is yet to be determined.

In the passage of H.M.S. *Thunder*, from Bermuda to Halifax, in 1835, the ship hove-to for the night, in order to search for this shoal, but it was not found. The *Sapphire* frigate had passed over the spot, at noon of the day before, but likewise unsuccessfully : yet, as vessels from Jamaica, Honduras, &c. may possibly have grounded on this reef, and have, consequently, foundered at sea, it claims a future and rigid examination.

FIELDS' VIGIA, lat. $37^{\circ} 31'$, long. by acc., $66^{\circ} 0'$?

An account of this vigia was published in the year 1833, but we are strongly inclined to think that it might be only a collection of weed, &c., in one of the southern eddies of the Gulf-stream, where, in abundance, it is frequently found.

Schooner, *Little Mary*, Capt. Fields, from Antigua to St. John, N.B., 1st April, 1833. "At 4 a.m. tried the temperature of the water, and found myself in the Gulf-stream. At 6 a.m. the water still warm. At 8 found the water very cold, and of a dark and muddy colour ; every appearance of being on soundings. At about a mile to the westward the surface of the sea appeared as if breaking, or rather rolling over a shoal ; saw great quantities of small fish rise occasionally in scholes, and porpoises. At 10 found the water warm again, and of the blue ocean colour, and continued so until 4 p.m. of the 2nd. Latitude of shoal, corrected at noon, $37^{\circ} 31'$ N. Longitude, by account, $66^{\circ} 0'$ W. Partly determined to return and sound, but the wind was fair, and as there was also every appearance of a N.E. snow storm coming on, was deterred from doing it. On making the land within the Bay of Fundy on the 6th, the reckoning was only 18 miles of longitude to west of the vessel ; and having sighted Bermuda on the passage, the longitude given of the shoal cannot be far from the truth."—*Journal*.

POTOMAC'S SOUNDINGS, lat. $38^{\circ} 10'$, long. $67^{\circ} 26'$.

On the southern side of the Gulf-stream, in the situation given above, soundings at 90 fathoms were found by Captain Smith, in the ship *Potomac*, of Alexandria, U.S., June, 1838, as shown in the chart.

Rocks to the Eastward of the Bermudas ?

Different charts of the Atlantic exhibit rocks at about a hundred leagues to the east of the Bermudas, upon the authority, it is probable, of Bellin, who has stated that, "About 100 leagues to the east of Bermudas, there is a little shelf of brittle rocks, which has been seen by one Louis Duhal, in a corsair, or privateer, that sailed around them ; and as this shelf is nearly on the parallel of the Bermudas, many have mistaken it for the rocks about those islands." M. Bellin has observed that, there are some rocks on this shelf whose tops are above the water ; but that many doubt their existence.

We have subsequently made inquiry as to these vigias, and have been consequently informed that rocks, *supposed* to have been seen by the late Captain Bell, of the *Francis Freeling* packet, were placed in about $33^{\circ} 45'$ N., and $55^{\circ} 25'$ W. The late Captain Hurd, who surveyed the Bermudas, assured us, that he did not believe rocks to exist in the

the position assigned : and he supposed that some who had advanced by error, too near the reefs to the eastward, or north-eastward, of the Bermudas, mistook them for rocks at a much greater distance from land.

A rocky bank, lying to the S.W. of the Bermudas, has been already noticed on page 418.

ASHTON ROCK, between the Bermudas and Cape Hatteras?

Ship *Wm. Ashton*, Captain H. B. Guy, 22d May, 1824. "At 11h. 50m. the man at the wheel saw *something* on the starboard bow, distant about one mile. Hauled the ship toward it, when we discovered it to be a rock ; passed to the westward of it at the distance of about two cables' length. The base of the rock appeared to be about 100 yards in circumference, on which the sea broke. In the centre was a point of rock in a form of a sugar-loaf, about 8 feet above the water, with a quantity of weed about it. [*Something like a whale?*] Passed the lead forward ; no ground at 80 fathoms. Blowing fresh, too much sea to lower the boat down.

"Latitude, by a good observation, 33° 48' 50"; longitude, inferred from lunar 21st May, at 19h. 31m., 71° 41' 20". The rock bore from us at noon S. 41° W., seven-tenths of a mile." (*Very doubtful.*)

HUNTLY'S ROCK, lat. 30° 49' 15", long. 78° 27' 30" ?

This danger (*if a danger*) was first made known by the following communication, addressed to Lloyd's, by Captain C. Huntly, in 1834.

"I sailed from Balize (Honduras) on the 17th of November, 1833 ; and on the 30th of November, at about 8h. 40m. a. m., saw something on the lee bow ; and at about 9 h. came abreast of it. I, with the rest of the officers and passengers, saw distinctly that it was a coral rock. We were about 60 yards to the southward of it. I immediately hove the ship to, and lowered down the quarter boat. Unfortunately the boat swamped, and with some difficulty I got the chief mate and boat's crew on board again. I got some very good sights by an excellent achromatic, and by a very good observation at noon, and by reducing the ship's run, I find that this rock lies in latitude 30° 49' 15", and longitude 78° 27' 30" West from Greenwich. It was about 8 feet above the water, and in the fall of the sea it branched out to the N.N.W. about 30 feet in distance."

[*If a rock really exists here, it must be on the eastern border of the Gulf-stream, and on the parallel of St. Mary's River. It has not been inserted in the chart.*]

IMAGINARY SHOALS between 30° and 40°.

The *Steen-ground* to the westward of Madeira, and a *Vigia* to the S.W. of *Flores*, represented in 37° 50' N. and 34° 18' W.

BETWEEN THE LATITUDES OF 20 AND 30 DEGREES.

GOMBAUD'S ROCK, in lat. 23° 15', and long. 32° 25' ?

According to M. Fleurieu, this danger was first seen in 1764, having been discovered by Gombaud, the commander of a merchant-vessel of Rochelle. Upon this authority, and *this alone*, it has been continued, and its existence is, therefore, doubtful.

Overfalls, or Heavy Ripples, in lat. 24° 11', and long. 61° 44'.

"On Sunday, the 7th Feb. 1819, at 10 a.m. the schooner *Brilliant*, Capt. Tulloch, on her passage from Gibraltar to Havanna, passed through very heavy overfalls, extending N.N.E. $\frac{1}{2}$ E. and S.S.W. $\frac{1}{2}$ W., *true*, as far as the eye could reach, with much sea-weed (*fucus natans*) in it. The breadth of the overfalls did not exceed half a mile. Course run from 10 a.m., W. by N., 6 miles an hour, equal to 12 miles. Latitude, observed at noon, 24° 10' 38". Hence the latitude, in which we crossed the overfalls, was about 24° 11' 11", after allowing 1' 45" S. for heave of the sea. The longitude of the overfalls, I found, by mean of three sets of lunars, stars Regulus and Aldebaran, east and west of the moon, continued to noon, by account, was 61° 43' 57" W. The preceding information was communicated by our friend Captain Livingston, by whom the lunar distances were taken. He adds, "None of us saw such a heavy ripple, except near land, before ; and both Captain Tulloch and I felt confident that, if there had been a fresh breeze, the overfalls

falls would have broke very heavily. We saw no danger, but both suspect some one exists hereabout, and there was a good deal of gulf-weed about the edges of the ripples.

“Mr. Cooper, late teacher of mathematics at Greenock, was, some years since, on a voyage from Martinique toward the United States; and, in nearly the latitude and longitude of the overfalls, above described, the ship ran through a ripple, wherein the water appeared almost as red as blood; and, he thinks that, if the current had run over a red sand-bank, of not more than 20 fathoms, the water could not have been redder. The captain declined sounding, and further particulars are unknown.”—*A. L.*

MOURAND'S BANK, in lat. $24^{\circ} 34'$, and long. $65^{\circ} 10'$?

This danger was discovered by Mourand, commander of the *Prince de Nizarré*, of Nantes, on the 6th of April, 1773. This person has the character of having been an intelligent navigator and accurate observer. He describes it to be a “bank of red sand, many parts of which are out of water, like detached islands, over which the sea breaks: it appeared to extend about a quarter of a league from North to South.” The journal of Captain Mourand's voyage having been submitted to the consideration of Messrs. Verdun, Borda, and Pingré, they have been enabled to calculate, with every probability of correctness, its true position.

GUIGOU'S BANK, in lat. $20^{\circ} 50'$, and long. $66^{\circ} 45'$?

M. Bellin, in the Memoir of his Chart, of 1742, describes this to be a “rocky bank, about 45 leagues to the northward of Porto Rico, upon which a Dutch vessel was lost in 1701, and that it had also been seen by a French vessel.” Another manuscript, in the *Depôt de la Marine*, confirms this account, and adds, “The commanders of both vessels declare, that a little island of sand appears on the middle of the bank, in latitude $21^{\circ} 24'$, and that the bank is 3 leagues in length. It also appears, from the deposition of Christopher Whipple, commander of the *Anna*, of Rhode Island, that he was wrecked on the 27th of November, 1733, upon a shelf, from 30 to 40 leagues to the northward of Porto Rico; which, there is little doubt, must be the same. In the *Marine Depôt* of Paris there is a manuscript, entitled, “Plan of the Shelf which was discovered by Captain Michael Guigou, of Seine, in Provence, on a voyage from Cape François, in the ship *La Concorde*, February, 1688.” On that plan it is placed at 45 leagues to the northward of Porto-Rico, somewhat nearer to the western than to the eastern end. It has been subsequently represented in different situations. That given above is the probable mean.

INGLEFIELD BANK, in $29^{\circ} 42'$ N. and $80^{\circ} 17'$ W.

This bank, lying about 66 miles East of St. Augustin, was discovered by Captain S. Hood Inglefield, on the 26th of May, 1810, latitude $29^{\circ} 42'$ N., longitude, by account, $80^{\circ} 12'$; by chronometer, $80^{\circ} 17'$; and by lunars, $80^{\circ} 18'$. Sounded in 25 fathoms, black sand: hence, steering N. by W. $\frac{1}{2}$ W. course, made good, had regular soundings, 24, 25, and 27, fathoms, speckled sand and broken shells, until 6 p.m. on the 27th, when no bottom could be found. Noon on 27th lat. $30^{\circ} 5' N.$, long., by account, $80^{\circ} 25' W.$, by chron. $80^{\circ} 25'$. On the 26th the current set W.N.W. one mile an hour: at 4 p.m. on 27th, no current. On the 28th, in lat. $31^{\circ} 5'$, and long., by chron., $79^{\circ} 46'$. Current ran N.N.E. $1\frac{1}{4}$ mile an hour.—*Communicated by Lieut. Jn. Evans, (a) R.N.*

VIGIAS BETWEEN THE EQUATOR AND THE PARALLEL OF 20 DEGREES.

HANNAH'S CORAL SHOAL, lat. $10^{\circ} 7'$, long. $27^{\circ} 32'$.

This shoal was discovered by Captain Thomas Fanning, of the brig *Hannah*, on the passage from Rio Janeiro to Trieste, June 25, 1824. It appeared to extend 150 fathoms N.E. and S.W., with two branches or arms from it on the N.W. side, and one on the S.E. side. Sounded in 15 fathoms, granulated coral, on the S.W. part, but supposed it much shoaler on the N.E. points, as the weed was plainly to be seen, from the mast-head, on the surface of the water. Its latitude was found to be $10^{\circ} 7' N.$, and longitude about $27^{\circ} 32' W.$ The latter was deduced from lunar observations taken the day before; but as a strong westerly current [the Equatorial] was experienced, it cannot be depended on within 20 miles. The latitude may be considered correct.

MARIA and BONETTA ROCKS, MADELINE REEF, WARLEY'S SHOAL, FRENCH SHOAL, CÆSAR BREAKERS, BOUVET'S BANK, &c.?

We have now the grateful task of introducing extracts from a letter, addressed to the Secretary of the United States' Navy, by Captain * *Chas. Wilkes*, commanding the South Sea surveying and exploring expedition, and dated on board the sloop *Vincennes*, at Rio Janeiro, Nov. 27, 1838.

It will be presently seen that the squadron effected the examination of the supposed position of ten or eleven shoals or dangers, the detailed accounts of which were formerly given in this work, their assigned positions in the charts, and the non-existence of which has apparently been *proved*. The search, in the first instance, was for *St. Anne's Shoal*, long since expunged, and which, of course, was not found; but hereabout they fell in with a large cotton wood tree, 120 feet long and 15 in circumference, which was, at first, reported as a shoal, and with a rough sea, in passing, it might have been mistaken for one. Captain Wilkes says, "I have little doubt but similar trees have occasioned the frequent reports of vigias or shoals being in existence hereabout.† Our position at this time was in latitude 37° 0' 37" N., and longitude 40° 41' 54" W., and where any floating bodies drifted by the Gulf Stream would probably have been deposited, as here is little or no current, and that variable.

"The first reported shoal laid down on our route upon the charts was the *Maria Rock*, in latitude 19° 45' N. and longitude 20° 50' W., which we stood for, and hove-to near the position, until we had ascertained our situation correctly, by careful observations. The vessels were then spread and the course marked to run directly over the spot; the surface of the ocean, visible at the time from the squadron, was not less than 60 miles in circumference, with every opportunity which the clear weather could afford, and sufficient swell of the season to have caused breakers on any shoal within 15 feet of the surface. Nothing, however, was discovered, and no bottom could be found with 300 fathoms of line.

"The next position examined was *Bom Felix Shoal*, said to be within 30 miles of the *Maria Rock*; this we searched for in the same manner, but were equally unsuccessful. We then stood for the place assigned to the *Bonetta Shoal*, to the eastward of Bonavista, said to be in latitude 16° 32' N., and longitude 20° 37' W. We in like manner hunted for this, and, after exploring the locality of its position on the chart, I steered on the course of its reported bearing, E. by N. from Bonavista, until nearly up with the *Hartwell Reef*, lying in sight of Bonavista, which has, without doubt, been taken for, and reported as, the shoal called *Bonetta*.

"Our inquiries at St. Iago assured me that the *Madeline* (the vessel last wrecked) was cast away on the *Hartwell Reef*, which has been reported as the *Bonetta Shoal*.

"I am well satisfied that the positions assigned to the above three shoals on the chart, and their vicinity, are free from all dangers. I am of opinion, also, that the particular and indefatigable search made by Captain Bartholomew, of H.M.S. *Leven*, and the opportunities afforded me of covering, with the squadron of five vessels, so large a space, at the same time, ought to be sufficient evidence that no such dangers exist as they are laid down in those positions, and should cause them to be obliterated from the charts.

"From Port Praya we steered for *Patty's Overfalls*, as laid down in the chart, in latitude 11° N., and longitude 24° 30' W., and had a good opportunity of examining their locality. A few rips were observed within a degree of the situation assigned them, but little or no current was found; and I feel confident in asserting that no danger exists in this vicinity, as we were becalmed in the position, and in close proximity to it for 48 hours, the squadron as usual being spread apart, and having a broad expanse of ocean under view. Owing to contrary winds it was some days before we reached *Warley's Shoal*, said to be in latitude 5° 4' N., and longitude 21° 25' W. This point was also carefully examined, but no shoal, or appearance of shoal water, or any danger, discovered.‡

"Our

* Professionally styled 'Lieutenant Commandant.'

† A more remarkable instance is noticed in the description of the search for Aitkin's Rock, p. 423.

‡ On this shoal, or *imaginary shoal*, the following remarks were previously made by Captain George Cheveley. In sailing from Madeira toward Pernambuco, I observed exactly in the latitude and longitude assigned to this shoal, a good lunar observation at the same time differed only two minutes from two chronometers. I lowered my boat down, and pulled due West several miles, and then returned

"Our next examination was of a *French shoal*, said to be (as laid down) in latitude $4^{\circ} 5' N.$, and longitude $20^{\circ} 35' W.$ This was also examined, and no danger or appearance of shoal discovered. From this point I took advantage of the southerly wind, and proceeded east; which carried me as far as 13° of west longitude, and over the position assigned to the shoal by the French hydrographers, to enable me to cross the equator eastward of the 17th degree of west longitude. We succeeded in crossing the equator in that longitude on the 5th of November, and then stood for the *Triton's Bank*, said to be in latitude $0^{\circ} 32' South$, and longitude $17^{\circ} 46' West$. When within a short distance of its position the squadron hove-to, for the purpose of ascertaining our position accurately; after which a course was steered nearly west. Being at the time well to the eastward, we ran on a line due east and west over it; the vessels of the squadron being spread about three miles apart, on a line north and south. We did not, however, find it in our progress, or any bottom or indication of soundings; no *discolouration* of water was visible, or change of temperature, although the line extended 30 miles east and west of its reported position; after which we again stood to the north, and ran over a *vigia* as laid down on the charts, but none such was found in existence.

"Our next examination was for *Bouvet's Sandy Island*, which was, in like manner, carefully searched after, in and around its position, as laid down on the charts, but our search was equally unsuccessful.

"Finally, search was made in and about latitude $2^{\circ} 43' S.$, and longitude $20^{\circ} 35' W.$ Extending to the N.N.W. of this point a distance of 30 miles hereabout, having been assigned as the situation of the sub-marine volcano reported by Admiral Krusenstern, which it was supposed might have left a shoal. This locality was twice run over in different directions, and carefully examined, with the squadron in open order, but none such was found in existence."

"Lieutenant Hudson, of the *Peacock*, having separated from me on the 16th of October, proceeded on a different course in search of the same shoals which we were looking for, but was equally unsuccessful in finding any, as appears by the following extract from his report to me, which affords further evidence, if it were needed, of their non-existence.

"Having separated from you on the 16th of October, it was not until the 23rd that I had worked up to the *Warley's Shoal*; and at 8 o'clock that night I was directly on the spot where it was laid down on the chart. We placed good look-outs, and kept our patent lead going for 50 miles before reaching the location of this shoal as laid down on the chart; also observing our drift at night, in hope of sweeping over it at early day-light. I continued cruising in this vicinity in various directions, getting casts of lead in from 50 to 100 fathoms, without finding bottom. I now continued my examination, and after having swept over a circle of 40 or 50 miles in different directions, am perfectly satisfied that *Warley's Shoal* exists nowhere in the neighbourhood laid down on the chart.

"I then proceeded for the *French Shoal*, with the wind a-head, (S. by W.) where I arrived on the 25th of October, and continued cruising all the following day, with a fine breeze, immediately over the location of the shoal as laid down, and in every direction for miles in its vicinity. After thus thoroughly searching the *English* locality of this shoal, I directed my course for the French position, 76 miles distant, making nearly an East course, with look-outs and the lead going, until I had run immediately over and around the spot, sailing in various directions a distance of 40 miles, without effect.

"I then made the best of my way for the *Triton Bank*, with the wind veering and hauling from S.S.W. to S.S.E. and passed the equator on the night of the 3rd of November, in longitude $17^{\circ} 40' W.$, and continued over and around the locality of that bank until the morning of the 5th, getting casts of the lead during the time in from 50 to 250 fathoms, up and down, without finding bottom. I have, in our search, fully satisfied myself, and hope our examination will prove equally so to you, and all others, that these shoals do not exist."

returned and pulled to the eastward, sounding occasionally. I am firmly convinced that no such shoal exists. I have myself fancied being in shoal water, when, upon examination, I have found the appearance to proceed from fish-spawn, or from a peculiar change the water often assumes in a heated atmosphere. It would be well, upon good authority, to eradicate all *supposed* shoals and rocks from the charts; they tend only to alarm the young navigator. It may be said that they serve to make you careful; but there are real dangers enough for that purpose.

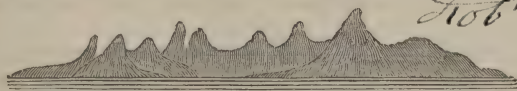
To the imaginary shoals above mentioned we may doubtless add the *Cæsar Breakers*, said to have been seen in latitude 2° N. and longitude 22° 18', in 1730; *Dubreuil's Vigia*, lat. 14° 50', long. 29° 40'; *Baro das Garcias*, lat. 13° 0', long. 29° 50'; *Vigia de 5 Palmas*, lat. 12° 0', long. 27° 20'; *Longchamps Rock*, lat. 9° 47', long. 30°; and the *Maalstrom*, in about 16° N. and 37° W.

PENEDO DE ST. PEDRO, otherwise called St. Paul's Islets.

A cluster of five steep craggy rocks without verdure, covered with bird's dung, and having no place fit for anchoring or convenient for landing. They are about a quarter of a mile in extent each way, and the highest part is about 100 feet above the sea. With a line of 100 fathoms, no bottom was found within two miles of the islets. The appearance annexed has been communicated by the intelligent master of a merchant-ship.



The rocks change materially in their appearance according to their bearing. The *Tellicherry*, East-Indiaman, passed in sight, in 1802, and found that the appearance, between N. 30° W. and N. 37° W., 6 or 7 miles distant, was that of a heap of rugged rocks, with low gaps between some of them. The northernmost, a small pyramidal rock, rather lower than the rest.



Penedo de St. Pedro West, 6 miles, as taken by Captain Monteth.

From observations made in the *Thames*, in 1798, compared with those made in several other ships, it is inferred, that the position is latitude 0° 55' 30" N., and longitude 29° 19'.

Commodore Brou, of the French frigate *Hermione*, in 1825, describes *Peñedo de San Pedro* as a mile in extent, in a N.E. and S.W. direction; seen in fine weather four to five leagues off; when bearing N.W. appearing in the form of three pinnacles of sharp naked rocks of a remarkable shape. The S.W. pinnacle separated a short distance from the others. The latter appears safe to approach, and no breakers were seen, to indicate sunken rocks. The *Hermione* sailed round on the eastern side, at the distance of 5 miles; did not try for soundings; but from the colour of the water it was presumed that bottom would not be found.

The Equatorial Current set the ship to the westward at the mean rate of 18 miles, and to the north six miles, in the 24 hours, between the parallel of 8° N. and the Equator, and the meridians of 28° and 30° W. At the islets the direction of the current changed and set more to the northward at three-quarters of a mile in the hour.

The best description of these isles is that of Captain Amasa Delano, who, in the American ship *Perseverance*, from Boston toward Cape Horn, 23d Dec. 1799, at 2 p.m. saw three small islands bearing W. by S. two or three leagues distant. The vessel bore away, and at 3 p.m. was abreast of them. Hoisted the small boat out, went on shore, and found them to be nothing more than a cluster of craggy rocks, about one-fourth of a mile in extent from North to South, and nearly as much from East to West. No sort of vegetation existed upon them. The rocks were found to be five in number, but only two of any considerable magnitude. Their greatest extent was from N.N.E. to S.S.W. The two largest nearly connect with each other, and form a kind of harbour, or place of shelter, for a boat, on the N.W. side. Here they managed to land, but obtained nothing excepting a number of boobies. On shore the aspect was most dreary; the sea roaring and surging on all sides. Two smaller rocks were lying off to the S.S.W. of the large ones, and one, very small, to the N.E. When on the highest part, which was at least 100 feet above the surface of the sea, no dangers could be seen but what showed themselves above water; nor could any be discovered from the ship. Plenty of fish were caught in the harbour, or basin. At 6 p.m. returned on board. Sharks were numerous about the ship; but, in attempting to take them, a number of hooks and lines were lost, and several pair of grannes broken. On sounding, within two miles of the islets, no ground could be found with a line of 200 fathoms.

Capt.

Capt. Delano states that the islets may be seen at the distance of four leagues, and always make like three sail when first seen. They are very dangerous if fallen in with by night. The current near them set N.W. by N. true, one mile an hour. The parts above the reach of the surf are covered with birds' dung. The birds were hatching their young at the time. The month of November would be the season for procuring eggs at this place, as they may be obtained at that time in abundance: but, being the eggs of oceanic birds, they are rather fishy than sweet. We have seen a different latitude assigned to the rocks, but consider it as incorrect.*

Captain Fitz-roy, from his observations, places the summit of the Peñedo in latitude $0^{\circ} 55' 30''$, and longitude $29^{\circ} 22'$. The variation here, on the 16th of February, 1832, was $9\frac{1}{2}^{\circ}$ W. Temperature of the air and water, 82° . Wind S.E. The rocks were seen on the horizon at sun-set of the 15th. They appeared extremely small at about 8 miles distant. At day-light next morning two boats were sent to land upon and examine them, while the *Beagle* sailed round, sounding and taking angles. Good observations were made during the day, as the sky was clear and the water smooth.

The multitude of birds which covered the rocks was astonishing, and they suffered themselves to be kicked about and killed with sticks; at the same time those on the wing even darkened the sky. While one party were scrambling over the rock, a determined struggle was going on in the water, between the boats' crews and sharks. Numbers of fine fish, like the Groupars (or garoupas) of the Bermuda Islands, bit eagerly at baited hooks put overboard by the men; but, so soon as a fish was caught, a rush of voracious sharks was made at him, and notwithstanding blows of oars and boat-hooks, the ravenous monsters could not be deterred from seizing and taking away more than half the fish that were hooked.

At short intervals the men beat the water with their oars all round the boats, in order to drive away the sharks; and for a few minutes afterward the groupars swarmed about the baited hooks, and were caught as fast as the lines could be hauled up,—then another rush of sharks drove them away;—those just caught were snatched off the hooks; and again the men were obliged to beat the water. When the boats returned they were deeply laden with birds and fish, both welcome to those who had been living on salted provisions.

"From the highest point of the rocks, which is 64 feet above the sea, no discoloured water nor any breaking of the sea, could be discerned, apart from the place itself; and from the soundings taken in the boats, as well as on board the ship, I conclude that it is unconnected with any shoal, being merely the summit of a steep sided mountain rising from the bottom of the ocean. A slight current was setting to the westward, not amounting to a mile an hour." (*Vol. ii. 56.*)

BLAESDALE'S REEF, in about $0^{\circ} 57' N.$ and $41^{\circ} 6' W.$

On the 15th of October, 1819, the brig *Richard*, of Ulverston, Capt. Blaesdale, struck on a coral reef, in about $0^{\circ} 56'$ or $0^{\circ} 57' N.$ and longitude, by *account*, beyond $41^{\circ} W.$ In fine moderate weather, the ship going at the rate of three knots, at 6 *p. m.* grounded, and remained fast about ten minutes. The water was smooth, and no breakers seen. Upon sounding, a few minutes after, no bottom could be found at 125 fathoms. The vessel drew 11 feet of water, and in one hour there were 18 inches of water in the well. On a subsequent survey at Para three holes were found, each about the size of a man's hat, and nearly through the vessel's bottom, and several large pieces of white coral, as large as a man's hand, were found sticking in different parts.

THE INDIA SHOAL, West of Cape Verde Islands?

This shoal is laid down from the chart of M. Rochette, 1777, on which it is stated to be mentioned in several journals of East-India ships, and to lie 70 leagues W. by N. (*true*) from St. Iago. We are unacquainted with the nature of the danger, but have placed it as it before appeared. Its position may be considered as *very uncertain*.

TEXEIRO'S SHOAL, in lat. $12^{\circ} 0'$, and long. $33^{\circ} 28'?$

Breakers seen by Don Angel Texeiro, captain in the Spanish navy, April 16, 1810, from the American ship *Topacio*, bound for Boston. They appeared to extend about a mile from North to South, and two cables' length from East to West; latitude, by observation, $12^{\circ} 0' N.$ and longitude $33^{\circ} 28'$ from lunars three days before.

* The late Captain Henry Foster gave the position as $0^{\circ} 58' N.$ and $29^{\circ} 16' 40'' W.$

GALLEON'S BANK, in lat. 15° 56', and long. 49° 40'.

This bank, or reef of rocks, was discovered on the 23d of July, 1730, by Longueville, the pilot of the San Fernando, commanded by M. de Navarro, Admiral of the Spanish Galleons. By the detail into which Longueville enters, concerning this danger, (his journal being in the Depot de la Marine at Paris,) there can be no doubt of its existence. It appears that the San Fernando struck on and passed over it, without receiving any damage. Other ships in the same fleet also struck, with more or less violence, but without actual injury. In the Depot de la Marine there is also a memorandum of the existence of a bank, in 15° North lat. and 228 leagues East of Martinique, upon which there is said to be 40 fathoms of water; bottom of fine sand; and over which Joachim Voette is said to have passed and sounded. Who this Joachim Voette was, is not mentioned, nor when he ascertained its position. If, however, this last-mentioned bank really exists, it may be the same as that over which the Spanish galleons passed.

M. de Humboldt has noticed that there exists in the parallel of the Island Dominica, and very near the 55th degree of longitude, a space wherein the water seems *constantly milky*, although the sea is very deep: and he asks, May there not be, in this place, some sunken volcanic islet?

We have already had occasion to notice the luminosity of the sea, as occasioned by mollusca, &c. (see page 382,) and shall here add a note from the narrative of the late Captain Tuckey, in order to show that the sea may be white without the agency of a volcanic islet. After passing Cape Palmas, and entering the Gulf of Guinea, Captain Tuckey observed that the sea had a whitish colour, which gradually increased till they made Prince's Island. The luminosity of the sea also increased, so that, at night, the ship seemed to be sailing on a sea of milk. In order to discover the cause of these appearances, a bag of bunting, having its mouth extended by a hoop, was kept overboard, and by means of it they collected vast numbers of animals of various kinds, particularly pellucid *scalpæ*, with innumerable little crustaceous animals of the *scyllarus* genus attached to them, to which Captain Tuckey attributed principally the whitish colour of the water. Thirteen species of *cancer* were caught, not above one-fourth of an inch long, eight having the shape of crabs, and five that of shrimps. Among these, the *cancer fulgens*, (a kind of little shrimp, emitting light,) was conspicuous. When another species was examined by the microscope, in candle-light, the luminous property was observed to reside in the brain, which, when the animal was at rest, resembled a most brilliant amethyst, about the size of a large pin's head; and from this there darted, when the animal moved, flashes of a *brilliant silvery light*."—*Tuckey's Voyage*, page 49.

BETSEY'S ROCK, in lat. 18° 7', and long. 50° 0'?

This is described as a flat rock, seen by the brig *Betsey*, on her passage from Greenock to Jamaica, 17th September, 1808. The captain of H.M. ship *Dædalus* spoke the brig off Port Morant, 9th Oct. 1808, and received this information from the master and passengers.

SOUNDINGS and DISCOLOURED WATER, in the ATLANTIC.

At 3 p. m., on the 15th July, 1792, Don Cosmé de Churruca, then on his passage to the West-Indies, discovered a boiling and breaking of the sea, so very extraordinary, that it appeared to be breakers; but they found no bottom at 150 fathoms. This phenomenon, which appeared to be in consequence of a current setting against the wind, accounts for the differences between the Observations and Dead Reckoning. Such circumstances as these have doubtless often given rise to a belief in the existence of Banks and Vigias which had no being.

On the 16th, at 10 a. m., they were in latitude 13° 56', and longitude 54° 7' West of Greenwich: and observed that the colour of the water changed, looking like muddy river water, or as if they were on a bank. They were 128 leagues to the eastward of the middle of St. Lucia, and 150 to the N.E. of the mouth of the Orinoco. They continued their course without alteration; sounded at night, and found no bottom at 120 fathoms. The captain, Churruca, says that the colour is always the same in that part of the ocean, always appearing as if on soundings, in that latitude and longitude, and that it never varies the position of its limits: and, in addition to his own remarks, he had assured himself of the fact by information collected from various sources, and that also the English sailing directions for the year 1782, entitled the *Complete Pilot for the Leeward Islands*, in the account of Barbadoes, mentions that this phenomenon is found at the distance of 70 or 80 leagues

to the eastward of that island, and that there are no soundings, though the water seems as if there were.*

The passage above quoted, from the old Book of Directions, is as follows :—

“ In the latitude of Barbadoes, about 70 or 80 leagues to the eastward, you will find the water discoloured, and prodigiously thick, as if there were soundings ; but there are none, and you may depend on being at the distance aforesaid from the Island.”†

“ In alluding to Mr. Luccock’s remark about the patches of water which exhibit a brown and dirty appearance, and also to the note from Captain Kotzebue in the ‘ New Sailing Directory for the Ethiopic,’ page 35, I should question, with all deference, whether the depth of water in such places, was tried to a sufficient degree of certainty.

On our passage from the West-Indies to Europe, in July, 1837, at about four in the afternoon of the 7th, a streak was observed on the surface of the sea, exactly in the same manner as Captain K. describes, and at the moment we passed over it the lead was hove in a very proper manner without finding bottom ; but, having lowered the boat, soundings were found to exist, although in more than 30 fathoms of water. The latitude computed from observations, taken at noon, was $21^{\circ} 12' N.$ and longitude, by chronometer, $58^{\circ} 42' W.$ —*A. H. Bisschop Greevelink.*”

DISCOLOURED WATER.—Captain Nockells, in the ship *Brightman*, of London, 5th of May, 1835, observing that the sea appeared of a dirty dark green, in latitude 41° , long. $39^{\circ} 19'$, (by chron.) tried for soundings, but found no bottom at 240 fathoms.

Captain N. in two previous voyages found the water in the same place very much discoloured, which he supposed might originate from the melting of the ice in the northern latitudes. *This subject has been partially noticed in page 429.*

Off the coast of Guyana, in the morning of the 17th of September, 1835, on the track of the *Echo* from Antigua toward Surinam, there appeared at about 7 o’clock, in every direction upon the surface of the ocean, several large spots of discoloured water, more or less thickly mingled, as it seemed, with mud. It was a fine morning, the sun rose in all its splendour, and not a single cloud was there to throw its shade upon the water, which was uncommonly smooth, although the ship ran six miles an hour ; besides, the water in some of the spots was so thick as to make the blue waves curl against their edges. Having, says M. Greevelink, the watch at the time, I gave warning of this strange occurrence to our captain, (the late and much lamented W. H. van Voss,) who came on deck and ordered me to keep (not to alter) our course, by which we passed through two of those spots, yet we did not heave the lead, as it was the first day in which we gained a breeze, after fourteen days struggling with horrible calm and rainy weather, and two-thirds of our crew confined to their hammocks.

While in the midst of these spots I observed the latitude by the moon, then passing the meridian, $11^{\circ} 47'$, and the longitude by chronometers, and at the same time by lunar distances, three excellent sets, $53^{\circ} 47'$. In about three-quarters of an hour we were clear of them, and the sea resumed its former clearness. The current, equatorial, for several days remained northerly, yet was not very strong.

That we had not been in soundings we felt nearly convinced by existing circumstances ; yet how came this muddy water here ? The common discoloured water of Barbadoes it was not, as the latter is a large extent of water of a different but somewhat lighter hue than that of the ocean, at least so far as we have seen it. As for my humble opinion, I seek for a cause of this appearance only in the force with which the Marañon rushes downward, but without sufficient power to strengthen the equatorial current. This may seem contradictory, but I think it may be found reconcilable in the manner following :—

This river impetuously pours forth its waters in a mass over a bed of some declivity, which steepens more and more toward its issue till it becomes a precipice so as to form a cataract, whereby a part of its stream may dive beneath the stratum of undulations of the

* It seems that the appearance of Soundings described above, occurs in the same place where Capt. Tulloch told me a bank existed, which some Americans were in the habit of making, as a first point of departure, when bound to Surinam, &c.—*A. L.*

† In 1813, at the distance of 197 miles to the eastward of Barbadoes we found the water discoloured : the thermometer rose here one degree. The Current [Equatorial] inclines to the northward here ; which, as well as the discoloured water, may be attributed to the stream discharged by the great river Orinoco, &c.—*Lieut. Evans.*

ocean, and afterward rise to the surface by its lesser specific gravity; where, driven still farther off by the northerly current, it may easily remain for some days in the above-mentioned manner, especially in those months wherein continual calms prevail, and the water is rarely disturbed by the wind.

GALISSIONIÈRE'S ROCK, about 12° 20' N. and 54° 49' W.?

This vigia was exhibited on the chart of M. Rochette as a rock mentioned by M. Galissionière and some other navigators. A spot, nearly in the same situation, had previously been called the *Isle of Fonseca*. It is said to have been seen by the *Rainbow*, a man-of-war. We have been lately informed, though vaguely, that the rock was again seen in 1822.

DELAWARE SHOAL, eastward of Trinidad.

Captain Ross, in the brigantine *Delaware*, from Charleston, on the 16th Sept. 1839, at noon, in lat. 10° 38', struck soundings in 37 fathoms, shells and sandy bottom. At 3 p.m. steering south, passed over a rocky bank, having 5, 7, and 10, fathoms, and bottom plainly seen: inferred from the distance run that the latitude of the shallow part of the bank must lie in 10° 37' N., longitude by chronometer, 60° 3' W. At 3½ p.m. had 70 fathoms of water.

MARTIN'S REEF, Eastward of Guadaloupe in about 16° 42' N. and 58° 45' W.

A shoal was inserted hereabout on the chart of Bellin, 1742, who says that it is mentioned by many navigators. "It was again seen in July, 1816, by Captain Martin, of the ship *John Manning*. The shoal seemed to consist of yellow sand, with sea-weed upon it: to be about half a mile in length from East to West, and a quarter of a mile in breadth, from North to South."

We have been informed, on respectable authority, that this reef was again seen by the ship *Cecilia*, of Glasgow, 19th July, 1823, by which the position assigned was 16° 44' N., and 58° 50' W. To the commander of this ship it appeared to be about 1½ or 2 miles long, and only about 30 feet wide: the western part, shaped like the bulb of a thermometer, seemed dangerous.

CLOWES' REEF, to the Northward of Porto Rico, lat. 19° 17', long. 65° 50½'.

An American schooner, in 1817, struck on a rock to the northward of Porto-Rico, in between 19° and 20° North. This was, probably, the same danger on which, some time after, the brig *Robert*, Captain Baxter, struck and remained several hours. The Reef, which has been variously represented on the charts, was seen by Captain Clowes, in the ship *Caledonia*, on the 24th of April, 1825; and Capt. C. assigns for its situation lat. 19° 17', and long. 65° 50½'.—It is about a quarter of a mile in extent from East to West, with very little water on it. A quantity of sea-weed was seen at each end, which appeared to be drifting to the S.W. The ship was within a mile of the reef.

ST. ESPRIT REEF, in lat. 14° 37', long. 58° 59'?

The following is a copy of a notice published in the London Daily Papers of October, 1817: "On the 4th of July, 1817, the French ship *St. Esprit*, bound from Marseille to Martinique, in latitude 14° 37', longitude 64° 18', 35 leagues distant from the island, fell in with a chain of rocks, about 8 feet under water, extending about 500 fathoms from North to South, and being about 100 fathoms broad, and were plainly seen on the bottom from the vessel. According to a sketch given of the reef by the Captain, it lies somewhat in the form of a half-moon; and the ship running westwardly with a strong wind, got within its horns, and narrowly escaped being wrecked, but made her way out by the south point. The reef, it seems, from its situation, must have been of recent formation, as it is in the track of vessels bound to Martinique, and is not known to have been before observed."

It was announced, in the year 1833, that H.M.S. *North Star*, on the 11th of February, while on her way from Antigua to Demerary, under the command of Lord Wm. Paget, struck soundings in 7 fathoms, near the position assigned to the Esprit Reef; and, in consequence of this, Vice-Admiral Sir Geo. Cockburn, commander-in-chief on the station, directed the ships of his squadron to search for the danger; these were the *Ariadne*, *Sapphire*, *Vestal*, *Forte*, and *Victor*, in January, 1834, and *Galatea*, in 1826; but, after a vigilant search, neither reef nor shoal have been found. (See *Naut. Mag.* Nov. 1834.) Again, on the 11th of October, 1833, H.M.S. *Dispatch*, Captain Daniells, passed over or near the place where the *North Star* struck soundings; the lead was kept going for six hours, without any indication of shoal water. It is, therefore, clear that the true situation of the danger has not been ascertained.

APPENDIX;

CONTAINING

HINTS AND REMARKS ON GENERAL NAUTICAL PRACTICE; WITH OTHER SUPPLEMENTARY PAPERS, TABLES, &c.

I.—MODE OF ASCERTAINING CURRENTS; LOG-LINE, LOG-GLASS, &c.; STEERAGE; SPANISH PILOTS; DEAD-RECKONING IN SHOAL WATER.
Communicated by Captain Livingston.

IN allusion to some remarks, made by an able writer, in a critique on the voyage of the Baron Alexander von Humboldt, Captain Livingston says, "The Reviewer censures M. de Humboldt for stating that, by comparing the place of the ship, as deduced from his chronometer, and comparing that with the pilot's reckoning, he was able to discover the smallest variation in the direction and velocity of the currents. The reviewer also says that the chronometer had not been rated; but on what authority he states this, I am at a loss to conjecture; as a man of Humboldt's acquirements and abilities could not, for a moment, think of ascertaining the longitude by means of a time-keeper, of which he knew nothing of the rate; and, indeed, it appears, in the same paragraph, that Humboldt predicted the exact time at which the land would be seen, and which, we presume, must be from the use of this very chronometer; of which he, consequently, must have known the rate.

"There can be no doubt that the LOG-LINE, GLASS, &c. are liable to be erroneous; but if the master, or whoever acts as pilot of a vessel, be attentive to his duty, any error in these will soon be discovered. For my own part, I can say that, rarely three days pass, when I am at sea, without examining the glass by the seconds' hand of my watch, and causing the log-line to be measured by marks which I have always measured off on the deck; and the length I have found, by experience, to answer best is 45 feet to the knot for a 28-seconds glass, and $48\frac{2}{12}$ nearly for a 30". In a vessel, however, the side of which was high out of the water, I have allowed something for the height of the side, which causes the line to make a different angle from what it does in a low one, and, of course, requires a little more length of line, proportioned to the vessel's height out of the water: but, what has been so often stated by seamen, 'that a fast-sailing vessel requires a shorter line than a dull one,' I have found, from experience, to be inaccurate; as I have been in both remarkably fast and remarkably slow vessels; and a careful attention to the log has convinced me of the equality of the length of line necessary for both.

"What has been said relative to steerage is strictly true, that 'a vessel's head vibrates according to the skill or want of it in a helmsman;' but it is really surprising how nearly, in general, the errors on the one side compensate those on the other; inasmuch, at least, as regards most vessels: a cutter, however, when running with the wind on the quarter, will always gripe to *windward*, in spite of the best helmsman.

"A sneer at the unskilfulness of SPANISH PILOTS is unwarranted.—Probably no country in the world produces better navigators than the Spaniards; as, in every maritime town, of note, they have a regular academy for Pilots, supported at the public expense, in which even the practical part of seamanship is taught on large models of full-rigged ships, which turn upon a pivot, so as to perform every manœuvre: and reefing or setting sails, with the other operations to be performed aloft, is done by means of such ladders as are used by painters. No person can take charge of even a *merchant-vessel*, as second pilot, until he has undergone a regular examination. If these regulations were adopted in Britain, it would be *well for our underwriters*, and save '*many fine ships and valuable lives*.'

"If CURRENTS are not to be ascertained by the difference between the ship's place by account and by observation, how are they to be ascertained? It may be answered, by the plan

plan proposed in all school-books, which is, by sinking a pitch-kettle, or other heavy article to a great depth from a boat; this I have often tried, but the results never appeared to me satisfactory: besides, the log-line, vague as it may be, must, in this way, still be trusted to. Again, if a current can be ascertained in this way, it will be a surface-current only; and there may even be a counter-current beneath, which, from its action on the kettle, or heavy article, to which the log rides, may make the surface-current appear to set more strongly than it really does.*

"I do not pretend to say that the mode of finding the set and velocity of currents, by comparing the ship's true place, as found by observations for latitude, or by lunar or chronometric observations for longitude, with that assigned to her by mere calculations of the courses and distances steered, is a certain one; on the contrary, I am conscious it is far from being so: but yet it seems to be the mode of practice by which the nearest approximation to the truth is obtained.

"If, on heaving the log, proper attention be paid to the mode of the person who heaves it, much inaccuracy will be obviated, and a person who has practice will come wonderfully near the truth. My own mode is, to take the average of the distance shown by the log at the beginning and end of the hour; as the distance run during it, except when any sudden increase or decrease of the ship's rate takes place, near the beginning or end of the hour, in which case I proportion it according to the best of my judgement; and often, under particular circumstances, I have caused the log to be hove more than once between the regular intervals of an hour, to satisfy myself. The error in *turning* the glass will seldom make one foot of difference.

"LEEWAY and HEAVE of the SEA must be taken into consideration. The former, in particular, is, at times, a puzzling subject, even to the most experienced, when a current prevails in any strong degree. Upon the whole, it must be allowed that those only who are well acquainted with, and practise, lunar and chronometric observations, can be sure of their situation at sea. No dead-reckoning, however carefully kept, can guarantee this."

DEAD-RECKONING in SHOAL WATER, as on the COAST of GUYANA, &c.—"As the greatest uncertainty in the situation of a vessel arises from the errors in the dead-reckoning, caused by currents, to diminish such errors, and render the computation more correct, it is advisable to take off the log-chip from the log-line, and to substitute a leaden weight, weighing 4, 6, or 8, pounds, as may be judged necessary; this, taking the bottom, (when the log is hove with it, in place of a log-chip,) will not so easily follow the vessel, or be influenced by currents. By this mode, it is clear the log will show the whole distance which the vessel runs, whether caused by winds or by currents. Then, having made fast the log-line, before you haul it in, mark the bearing of it, and the opposite point or direction will be the course which the vessel makes good. It is clear that, by this mode, the course and distance ought to be as exactly found as if no current existed. If you heave the log with a chip, in the usual manner, as well as a log with a lead attached to it, and compare the distance by it, and the course which the vessel appears to make by compass, with the

* "A surface-current, it is to be observed, is the only one that affects a ship's way. I think that counter or under-currents are seldom to be found in the open ocean."—*Abr. Bristow*.

On coasts, however, counter-currents may probably exist where they have been little suspected. Of this, a remarkable instance has been given by Captain BEAUFORT, R.N., in his classical and elegant description of the coast of KARAMANIA or ASIA MINOR. "From Syria to the Archipelago there is a constant current to the westward, slightly felt at sea, but very perceptible along the shore, on this part of which it runs with considerable velocity; as, between Adratchan Cape and the opposite island, we found it one day almost three miles an hour. The configuration of the coast will, perhaps, account for this fact. The great body of water, as it moves to the westward, is intercepted by the western coast of the Gulf of Adalia; thus pent up and accumulated, it rushes with augmented violence toward Cape Khelidonia, where, diffusing itself in the open sea, it again becomes equalized.

"The cause, the progress, and the termination, of this current will form an interesting subject for future investigation. To trace its connexion with the volume of water, which enters by the Strait of Gibraltar, the influx of currents from the Euxine (Black Sea), and the effect of the Nile, and of the lesser rivers of Asia-Minor, will require a series of corresponding observations on both sides of the Mediterranean. The counter-currents, or those which run beneath the surface of the water, are also very remarkable: in some parts of the Archipelago they are sometimes so strong as to prevent the steering of the ship; and in one instance, on sinking the lead, when the sea was calm and clear, with shreds of buntin, of various colours, attached at every yard to the line, they pointed in *different directions, all round the compass.*"

distance

distance and course found by the proposed method, you will be able to ascertain the direction and velocity of the current."*—*Derrotero de las Antillas*.

NOTE, BY THE TRANSLATOR.—In using the log-line with a leaden weight, as recommended above, I am of opinion that a few fathoms of extra stray-line should be used; and, if great accuracy be required, as in making the comparison between it and the common log, &c., to ascertain the strength of the current, an allowance should be made for the angle the line makes with the surface of the water, in order to equalize it with the log-line, as usually hove.—*Andr. Livingston*.

II.—ON THE COMPUTATION OF LATITUDE; WITH A TABLE FOR CORRECTING THE SUN'S OBSERVED ALTITUDE.

FOR the following Remarks on computing the LATITUDE, we are obliged to our friend, Captain Abr. Bristow.†

"While so many able pens have been employed in improving the methods of finding the Longitude, the Latitude seems to have been neglected. Dr. Maskelyne is, I believe, the only person who has given a clear and succinct rule for deducing it from a meridional altitude. It is much to be wished that this rule should be given in all our books of navigation, instead of the confused rules commonly found therein.

DR. MASKELYNE'S RULE is given on page 14 of the *Explanation of the Requisite Tables*, and to the Example is annexed a brief scholium, stating that, "It has been usual to divide the rule for this problem into different cases; but the necessity for such division arose from considering improperly, the zenith of the place as a fixed point, instead of the sun."—With deference, I should consider it of no consequence, whether either the zenith or the sun be considered as a fixed point; and, in fact, neither of them are; but rather, a moveable *known* point is given, in order to find a moveable point *unknown*. On islands, or in ships at anchor, the zenith is stationary; yet, between the tropics, the denomination of the zenith distance is changed by the apparent alteration of the sun's place.

I would recommend to every person, when working his latitude, to attach the names to the zenith distance and declination, respectively, in order to prevent mistake; particularly

* That is, the surface-current.—*A.B.*

† The scientific navigator may consider an injunction as to the necessity of adjusting a quadrant, or of previously ascertaining the index-error, as trifling and superfluous; yet there is reason for believing that many erroneous latitudes are given from this cause, even to the present day. Captain Livingston says, "I have myself lately been witness to a master, fifty-six years of age, who has commanded many vessels, some of them of the port of London, actually observing for several days with his quadrant five minutes out of adjustment. He asked me one day to observe with it: I perceived the error, and offered to adjust it, but could hardly persuade him, as he said, 'it had not been touched by any one but himself since it was cleaned; and, therefore, could not possibly be out.' In the end, however, he allowed me to rectify it; and then, to his astonishment, found it to agree with the other quadrants on board." This is not a *solitary* case, and is given as a general caution.

Allowing for the index-error is very preferable to being continually adjusting. Capt. Bristow has said, "I purchased my sextant of a maker distinguished by his skill, science, and integrity; and, during a *practice of twelve years with it, I never turned a screw.*"

Captain Livingston again says, "I disapprove as much as Captain B. does of what Mr. Troughton calls 'torturing an instrument,' but even Troughton directs how to adjust his circles; and with such high authority I cannot but think it well to know how to adjust instruments; though that is no reason for any one's constantly trying to adjust them."

Many teachers of navigation never instruct their pupils how to find the index-error, nor even how to ascertain whether the instrument be correct or not.

In relation to this subject *Lieut. W. H. Brady* has said, "It has occurred to my experience to hear a difference of opinion between observers, even as to the *degree* of altitude for latitude, longitude, and time, after the observations had terminated, and when, from the state of the atmosphere, they could not be repeated; and also to know that the person employed to record the observations has done so incorrectly. I beg, therefore, to suggest a simple mean of avoiding the possible evil consequences of such disagreement. The method, I believe, originated with *Captain Rixon*, of the *Orynthia* free trader. The cases for his quadrant and sextant were made sufficiently large to receive these instruments with the indexes set to any part of the arcs; in which form they were always replaced in the cases. Hence a reference to the instrument would always remove dubiety, with respect to the last altitude: nor is it clear that something might not be gained in keeping the instruments in better adjustment."

when

when near the line, in the neighbourhood of the sun, or when the declination is only a few minutes from the equator.

I have been led to the consideration of this matter, as above expressed, by a circumstance or two which fell under my own observation. In the month of September, at the time the sun crossed the line, three or four ships, from the coast of Africa, were bound to the island of St. Helena, (in latitude $15^{\circ} 55' S.$;) but, in consequence of their commanders not positively knowing how to calculate the latitude, from a meridional altitude, they missed the island, and proceeded several degrees to the southward of it before the mistake was discovered. The mistake, it seems, had arisen from *subtracting*, instead of *adding*, the declination to the zenith distance, from the time it had altered its denomination. The fact was confirmed to me, (for I had heard of it before, but questioned its truth,) by one of the masters, in November, 1804, a few years after it happened.

In the preceding March, of the year last mentioned, the *Santa Anna*, Moody, master, was off Norfolk Island, to the northward of New Zealand. The captain was on shore, on business, and the mate was left in charge of the vessel: the sun now crossed the line, and the ship was out of sight of land: the officer, on getting his observation, misapplied the declination; which, on the first day, produced an error in latitude of 46 miles *northerly*, by *adding* the sun's declination, instead of *subtracting* it: the next day he was full 92 miles out, &c.* The island, in consequence, could not be found; and the commanding officer, quite bewildered, got to the northward in imminent danger, unable still to form any idea of his real situation: at length, he resolved to steer to the westward, and thereby made New South Wales. Having discovered this coast, he was fortunate enough to *guess* his error, and directed his course accordingly; and, after a most perilous cruise of six weeks, the *Santa Anna* got safely back to Norfolk Island. In the mean time, the captain, supposing the ship to be lost, had left the island for Port Jackson, whither his ship followed him.

When such events as these happen, can it be superfluous to simplify and illustrate the method of finding the latitude; and ought not some step to be taken for correcting the rules given in our common books of navigation, as Moore's, &c.? One of these was probably the companion of the officer of the *Santa Anna* in his ramble.

The figure annexed is designed to exemplify this case, supposing the sun to cross the line between the 21st and 22nd of March.

E.Q. Represents the equator, from which latitude is reckoned.

N.S. The meridian line, on which it is measured.

A.B. The parallel of declination on the 21st of March.

C.D. The same on the 22d of March.

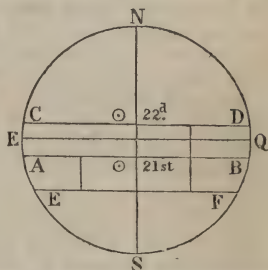
E.F. The parallel of the observer.

It appears, in this case, that, on the 21st, the space between A.B. and E.F. was the zenith distance *south*, or the sun's distance from the observer *north*; and, that the distance between E.Q. and A.B. is the declination South; therefore, the space between E.Q. and A.B. must be added to the space between A.B. and E.F., to give the distance between E.Q. and E.F., the latitude south.

On the 22d, it seems that, the distance between C.D. and E.F. is the zenith distance, or the ship's distance from the sun South, that the space between E.Q. and C.D. is the declination North. Therefore, the space between C.D. and E.Q. must be subtracted from the space between C.D. and E.F., to leave the difference between E.Q. and E.F., the latitude South. Instead of this, the observer added the space between E.Q. and C.D. to the zenith distance, the space between C.D. and E.F., which produced an error two-fold to the distance between E.Q. and C.D., the sun's declination.

The reverse of this was the case, in the month of September, with the four ships already mentioned.

It is always to be observed that, the zenith distance, or rather the sun's distance from the observer, or the observer's from the sun, bears a character opposite to the sun's bearing at



* Here mark the difference between March and September.

noon. If the sun is in the zenith, or if the sun has no zenith distance, the declination is the latitude.

When there is no declination, the zenith distance, or distance of the sun from the observer, is the latitude of a denomination opposite to the sun's meridian bearing.*

EXAMPLES.

WITH the Sun bearing SOUTH.				WITH the Sun bearing NORTH.			
From	90°	0'	the zenith.	From	90°	0'	the zenith.
	48	57	Meridian altitude, corrected.		48	57	Meridian altitude corrected.
	41	3	Zenith distance North.		41	3	Zenith distance South.
	15	1	Declination North.		15	1	Declination North.
	56	4	Latitude North.		26	2	Latitude South.

ALTITUDE OF THE SUN'S LOWER LIMB.

On the last page of this work will be found, for the convenience of daily reference, a new and useful TABLE for CORRECTING the OBSERVED ALTITUDE of the Sun's LOWER LIMB, by Mr. Wm. Galbraith, of Edinburg. The ingenious computer of it, in a letter to Dr. Brewster, one of the learned conductors of the Edinburgh Philosophical Journal, states that, it is intended to facilitate the method of correcting the observed altitude of the sun's lower limb by the fore observation at sea. It contains the joint effect of the sun's semi-diameter, dip of the horizon, refraction, and parallax, and is always to be *added* to the observed altitude, to find the true. In the computation of the Table, the sun's semi-diameter is taken at 16'; and its variation from this quantity, in each month of the year, is given at the bottom of the Table, which must be added to, or subtracted from, the correction found in the Table, which may be done at sight, according as the sign is + or —. It may be remarked, too, that the Table does not extend to altitudes lower than 5°, the lowest altitude at which observations can be taken, to be depended on for their accuracy. This renders all the numbers *additive*, except the small table of corrections for the variation of the sun's semi-diameter, which may, in most cases, unless a dip-sector is used, be neglected; since, according to the accurate observations with this instrument, by the ingenious Captain Basil Hall, much greater errors, arising from the variable state of the horizontal refraction, when this instrument is not used, are unavoidable.

EXAMPLE.

The observed altitude of the sun's lower limb, by the fore observation, is 48° 46', and height of the eye 20 feet, in the month of November; required the true altitude of the sun's centre?

1. By this Table.	
Sun's obs. alt. lower limb,	48° 46'
Correction to 49°, 20 feet,	
and November	..... + 11
True alt.	<u>48 57</u>

2. By the usual Tables.	
.....	48° 46' 0
Semi-diameter	+ 16 12
Dip	..... — 4 26
Refraction	..... — 50
Parallax	..... + 6
True alt. as before,	<u>48 57 2</u>

Hence the simplicity of our method is evident, while it obviously possesses all the requisite accuracy, since it never can deviate more than one or two tenths of a minute (or 6 to 12 seconds) from the truth, and is, therefore, fully sufficient for all purposes at sea.

* For a judicious remark on the necessity of gaining the latitude by altitudes of the planets or fixed stars, when the sun is near the zenith, see the preceding part of this work, page 246.

III.—OF LONGITUDE BY LUNAR AND CHRONOMETRIC OBSERVATIONS.

Captain Bristow has justly observed that, the computation of longitude, by mean of lunar distances, is one of the most grand improvements in the science of navigation : but he adds, “ According to an old adage, ‘ nothing is so good but it may be perverted, and sometimes turned into an evil ;’ so lunar observations, by being abused, have sometimes been productive of misfortune. The theory may be learnt by a school-boy ; but the practice, when lives and property are at stake, requires much skill and circumspection.

“ Captain Flinders, than whom, perhaps, a more skilful navigator has not existed, says that, ‘ Allowing every degree of perfection to the observers and their instruments, they will probably be twelve, and may be more than thirty, minutes wrong.’* This shows how much allowance should be made in the practice. We have, undoubtedly, some lunarians so conceited, that they would be ‘ grievously offended if told that they could deviate so far from the truth. Nevertheless, to the wise caution of Flinders, I would humbly offer one of my own, which is, when error is unavoidable, always *to err on the safe side* ; by this I mean that, when running for land, on the faith of a lunar observation, to be sure to be far enough a-head.

“ In order to regulate this, I would recommend to every person to examine the lunar distances in the Ephemeris, and see whether more or less be requisite for that purpose, and observe accordingly. I do not mean to go upon extremes in this point ; but, if more distance be necessary to carry the ship a-head, be sure to have the limbs in contact ; and, if less, not to observe too near : this may prevent fatal errors.†

“ It is much to be lamented that, since chronometers have been so commonly in use, the lunars have not been so much practised as they ought to be. The two practices, when combined, assist and regulate each other ; but lunars, as the basis, should be considered indispensable ; while *Observing* may be greatly promoted by so excellent a criterion as a good time-piece, which may settle to *what limits the lunars may be trusted*, by noticing how they agree or differ, when taken within short intervals of time ; and this, allowing a small error in the rate of the watch, must be a good check from day to day. Four seconds, it is to be recollected, is only a mile, and that is a great allowance for the alteration of a rate in only twenty-four hours.

“ For upwards of twenty years past, I have navigated my ship by the lunar method only. On all my passages I endeavoured to embrace every opportunity of *getting distances*, and depended on the result according to circumstances. If the sea was smooth, with fine clear weather at the time of observation, I concluded my longitude to be entitled to much confidence ; but my general allowance for error was *forty-five miles*. However, I do think that, in a thousand observations, not one in ten varied thirty miles from the truth ; and, in general, they were within ten or fifteen. My voyages have been such as have afforded me ample means of seeing how much lunars may be confided in : one to the Pacific Ocean ; three around the Globe ; two to New Zealand, and thence to the Molucca Islands ; and one to the Moluccas and Coast of New Guinea. It will appear, from the last six voyages, that I had to cross a vast tract of ocean without seeing any land ; and, as I had no opinion of a log, nor seldom used any, I navigated entirely by lunars, and have the satisfaction of saying that they never deceived me.”—A. B.

The Spanish Nautical Almanac, for 1820, recommends to mariners this remark :—“ In taking angular distances of the moon and stars, care should be taken never to allow the star to bite upon the moon’s limb ; but that a clear space, which can be distinctly seen, should be kept between them, in order to hinder the scintillations of the star from confusing the eye. The writer supposes 40 seconds sufficient for this, and proposes that this should be added when the nearer limb of the moon is observed, and subtracted when the farther

* See page 68 of the Tables composed by the editor of this work, and prefixed to the ‘ *Oriental Navigator*,’ quarto, 1816. The notes to these Tables include the whole of Captain Flinders’ explanation of his modes of determining longitude, which should be known to every seaman.

† It has, however, been remarked by another of our friends, that it is as easy and accurate to allow liberally for an error (toward the safe side) as to attempt observing inaccurately, in order to gain the same result.—EDIT.

limb is used. The reasons seem satisfactory; particularly as, in observing from stars East and West of the moon, the observations would not correct each other: but allowing the star to bite too close would increase the one distance, and decrease the other, having the effect of, perhaps, giving two erroneous results, which might, nevertheless, agree."—These remarks are stated to be from the pen of an officer of much experience.—*A. L.*

IV.—*Remarks on ASCERTAINING LONGITUDE, and the Use of CHRONOMETERS, &c.*

1. *From the Directory of the late Captain Horsburgh, F.R.S., &c.*—"Chronometers would be highly useful for the improvement of marine geography, were navigators to adopt a *uniform method*, in marking in their journals the longitude obtained by these excellent machines. In taking a departure for chronometers, at sailing from any port or head-land, the longitude *allowed* to that place should be marked distinctly in every ship's journal; and the longitude measured from it by chronometers (whether East or West) to every head-land, island, or danger, during the passage, ought to be carefully stated; by which means, the *relative meridians* of those places will appear to view, and be ready to compare with the admeasurement of the same by other chronometers.* But, unfortunately, the generality of navigators seldom mention in their journals the longitude allowed to the place of departure; and, instead of carrying on the longitude *made* daily from that meridian, by chronometers, they mark longitude *in*, by chronometers. The journals, therefore, are of little or no use for any future purpose, on account of the *indefinite* manner in which the longitude is marked by chronometers.

"When the longitude, obtained by lunar observations, is carried on daily by chronometers, or up to any head-land, it ought also to be marked distinctly, in order to prevent any mistake.

"When lunar observations are taken, the objects on both sides of the moon ought always to be observed, if possible, and the mean taken; which will contribute to correct or modify the errors of the instrument, particularly when the distances are *nearly equal*, and fall on the *same part* of the arch of the sextant: and the difference of longitude *run by log*, between day and night observations, ought never to be applied in carrying on the one to the other, if there is a chronometer on board. If, for instance, some observations of the sun and moon are taken in the afternoon for longitude, altitudes of the sun should be taken nearly at the same time, to obtain the error of the chronometer, or what it is fast, or slow, for the apparent time at ship; having also marked down the time, by chronometer, when the distances of the sun and moon are observed, the error of chronometer must be applied to it, to reduce it to the apparent time of observation. When the observations are taken afterward by the moon and stars in the night, the time, by chronometer, ought, likewise, to be marked down: to which apply its error, and the quantity of loss or gain of the chronometer, (proportionate to its daily rate,) for the interlapsed time between these observations and those taken in the afternoon by sun and moon. The apparent time at ship, when the observations of the moon and star were taken, will then be measured by chronometer to the meridian of the place where the observations of sun and moon were taken in the afternoon, and the mean of both should be taken for the longitude of that place, after comparing the apparent time of observations with the Greenwich apparent time. By using the chronometer in this manner, the errors liable to arise from currents, and from the advancement of ships' run by log, *between* day and night observations, will be avoided."

2.—GENERAL and Important RULES given by Capt. RICH. OWEN, R.N.

1. The time for receiving chronometers on board, previous to sailing, will differ a little according to circumstances; but it is strongly recommended that they should be received

* "To show the utility of this, the following example may be given:—In the journals of two ships, which saw the Brill Shoal and Middle Island, in the Straits of Salayer, at different times, I find they had lunar observations in both ships, which, the journals assert, may be depended upon in fixing the longitude of those places. It, nevertheless, happens, that the observations differ 20 miles; for those taken in one ship make the Brill Shoal and Middle Island 20 miles more easterly than those of the other ship: but, having chronometers on board of both ships, they *agree exactly* in measuring the difference of longitude between the Brill Shoal and Middle Island, although there is a *difference* of 20 miles in stating the longitudes of these places by the lunar observations."

on board at least a week previous to sailing, in order that a rate may be obtained for them, in the position and place they are constantly to maintain, as it may be taken for an absolute maxim in general practice, that *the rate of a chronometer obtained on shore will not be the same when removed to the vessel*. There may be a few exceptions to this general rule, but it must still hold good as a practical maxim.

2. The first thing to be attended to after the time-keepers are on board, and in their proper place, is to be regular in the time, and careful in the manner, of winding them up. Our practice on board the *Leven* was to wind up at noon, and never *pipe to dinner* until they were reported to be wound up and compared. Some method of this kind may always be adopted in men-of-war, and it would be adviseable in merchant-vessels to devise some plan by which the winding up of the chronometers should not depend upon the memory of any single person, the want of which must, in many instances, have caused the watch to run down; which will, at all times, alter its rate, and, not unfrequently, injure the chronometer. Our eight-day watches we wound up on Sunday, which will always be better remembered than any other day in the week.

In winding up the small chronometers in watch-cases, the left hand should rest against the body of the person winding it up, to prevent his giving it a rotatory motion by turning the watch *on* the key, instead of the key *in* the watch. This practice is very common, and very bad.

In winding up chronometers, the turns of the key should always be counted, and the last turns made gently and carefully, until it is felt to butt. It has sometimes happened to persons over careful that they have let their chronometers run down, by having calculated the number of turns, and never winding close up, from fear of injury to the chain or works, by which they have always lost a little of the chain each day, and after two or three months the chronometer is found to stop just at the time it should be wound up.

3. Of all the methods used by seafaring men to ascertain the rates and errors of their chronometers, that by equal altitudes of the sun in an artificial horizon is much to be preferred, both on account of its simplicity and the very great degree of correctness attainable by it, and being likewise free from the effects of instrumental error, or wrong latitude. The observations may be made at any time, with a sextant, when the sun's altitude falls between twenty and sixty degrees, provided it be not too near noon, as under two hours, or at least one hour and a half, the sun's motion, in high latitudes, being then very slow.

4. The method of rating chronometers by *lunar observations* obtained at sea, has been by some much insisted on, but we are fully satisfied that they can never be made use of, for that purpose, in general practice. Lunar observations are of great use for detecting a *gross error* in the longitude by chronometer, from any sudden change of rate or defect in the watch, &c.; but it must be evident that, where this is discovered, it would be unsafe to trust to such a chronometer for the remainder of the voyage. We would not be understood to discourage or depreciate the lunar method of obtaining the longitude, as we are fully aware of its great utility, particularly in long voyages; but we would strongly dissuade persons from using such means for *rating* their chronometers.”*

3.—REMARKS *extracted from those of* CAPTAIN FITZ-ROY, R.N.

“Frequently employing chronometers in boats and very small vessels has strengthened my conviction that *temperature* is the chief, if not the only, cause, generally speaking, of marked changes of rate; and the balances of few watches are so well compensated as to be proof against a *long* continuance of higher or lower temperature.

“It often happens that the air in port, or near the land, is at a temperature very different from that over the open sea in the vicinity. Hence the difference sometimes found between harbour and sea rates.

“The changes so frequently noticed to take place in the rates of chronometers moved from the shore to the ship, and the reverse, are well known to be caused partly by change of temperature, and partly by change of situation.

“I have never found chronometers go better than when the boxes were bedded in

* *Essay on the Management and Use of Chronometers*, by Richard Owen, Comm. R.N. Prefixed to the volume of *Latitudes and Longitudes of the points of Africa*, &c. by Capt. W. F. Owen, 4to., 1827. saw-dust

saw-dust, and the watches moving freely in well-oiled gimbals. Suspending them in cots not only alters their rate, but makes them go less regularly.

“When fixed to a solid substance, they feel the vibrations caused by people running on the decks, by shocks, and by chain-cables running out. A cushion, wool, hair, or any such substance, is preferable to a solid bed; but I can think of nothing better than plain dry saw-dust.

“The *Beagle's* chronometers were suspended in gimbals as usual, within a wooden box, each was placed in saw-dust, divided and retained by partitions, upon one of two wide shelves. The saw-dust was about three inches thick below, as well as at the sides of each box, and formed a bed for it which rose rather above the centre of gravity of the box and watch; so that they could not be displaced unless the ship were upset. The shelves, on which the saw-dust and boxes were thus secured, were between decks, low down, and as near the vessel's centre of motion as could be contrived. Placed in this manner, neither the running of men upon deck, nor firing guns, (forward,) nor the running out of chain cables, caused the slightest vibration in the chronometers, as often proved by scattering powder upon their glasses, and watching it with a magnifying glass, while the vessel herself was vibrating to some jar or shock.

“All the watches were in one small cabin, into which no person entered, except to compare or wind them, and in which nothing else was kept. The greater number were never moved from their first places, after being secured there in 1831, until finally landed at Greenwich in 1836.”—*Captain Fitz-roy's Appendix*, pp. 325, 6.

4.—Of the wonderful improvement in the construction of chronometers there cannot be a better testimony than the official report of the Board of Longitude, of the trial of chronometers, 1824. The annual prize, of three hundred pounds, was awarded by the Board to Mr. W. Widenham, for the best chronometer, it having varied one second and 80 hundredths of a second, on its mean daily rate, during the twelve months. The prize of two hundred pounds was awarded to Mr. J. M. French, for the second best chronometer, his having varied one second and 85 hundredths of a second, during the twelve months, 85 hundredths of a second during the last nine months, and 45 hundredths of a second during the last six months, on its mean daily rate. Mr. French's chronometer, No. 720, was made the standard, during Dr. Tiarks' operations for ascertaining the longitude of Madeira, in July and August, 1822, (noticed on page 36,) and its accuracy during the time it was under his care, induced him to take the longitude of Funchal from it. Dr. Tiarks takes the mean of the whole sixteen chronometers employed upon the occasion, by interpolation; and the standard gives the same result as the whole sixteen, within two hundredths of a second. Dr. Tiarks was again employed by the Admiralty, on the recommendation of the Board of Longitude, in 1823, to find, by chronometers, the differences of longitude between Dover and Falmouth, and Portsmouth and Falmouth, as shown on our page 5. His results were as follow: *Difference of time*, at Dover station 5m. 17sec. 54 E.; Portsmouth Observatory, 4m. 24sec. 77 W.; Pendennis Castle, 20 m. 10 sec. 85 W.; Funchal, 1h. 7m. 39sec. 08 W. Or *Longitudes*, of the Dover station 1° 19' 22" E.; Portsmouth Observatory, 1° 6' 11" W.; and Pendennis Castle 5° 2' 42" W.; the difference being a little less than had been previously stated. (See page 5.)

The results are the more surprising when we consider the effects of magnetism and temperature, which so frequently disturb the rate of these valuable machines. Of magnetism, a remarkable example has lately been given in the Transactions of the Royal Society of Edinburg. Mr. Harvey, the author of the investigation, by employing a very delicate apparatus, capable of detecting the minutest traces of attraction, discovered very remarkable varieties of magnetic power in a time-keeper. On examining the balance, Mr. H. found the inner rims of the arcs of compression to be of steel, and which, together with the time-screws, were in a state of active magnetism; particularly the latter, one having strong northern polarity, and the other southern. The small wormed cylinders, also, on which the thermometer pieces moved, presented equal proofs of polarity, one being a north pole, the other a south pole.—*Journal of Science, &c.*, No. XXXIV.*

Upon the influence of magnetism on the rates of chronometers, see, also, two papers, by

* In the three prize chronometers of the season 1832, the actual error, on any of their rates, during the year, did not amount to two seconds of time!

Mr. Harvey, in the 19th and 20th numbers of the *Edinburgh Philosophical Journal*, which are devoted to the consideration of the changes which time-keepers undergo, by altering their positions with respect to the attracting force. For the effect of Lightning, see, in the present work, page 136.

5.—THE FOLLOWING EASY METHOD of comparing the TIME indicated by any number of Chronometers, with the GIVEN time at a certain station, was published by the Rev. F. Fallows, Astronomer at the Cape of Good Hope, in 1824.

“Let a transit instrument, or even a sextant with an artificial horizon, be established in a conspicuous situation on shore, where a clock can always be regulated to true time : then provide a powerful Argand's lamp with a shutter, so as to be able to darken the lamp instantaneously : a few minutes before a certain hour in the evening, notice being previously given to the ships, let the lamp be lighted, and at the proper instant of time let it be darkened : this may be repeated several times at short known intervals. Then the errors of every chronometer on board of all the ships from which the lamp can be seen, are immediately found. After a certain number of days, let the same be repeated, when the daily ship rates will be given, since they are only the differences of these errors divided by the number of days elapsed between the two sets of observations. It is evident that, for greater truth, these observations may be repeated at pleasure. No objection can be made from the chronometer's being generally below deck, as one person might have his eye upon it, and another immediately above him, on the upper deck, might give a stamp with his foot the instant the lamp is darkened.” But the superior method is by the time ball, lately established, as shown in page 349.

V.—ON THE PROPER METHOD of laying down a SHIP'S TRACK on SEA-CHARTS; with some REMARKS on the IMPORTANCE of TIME-KEEPERS in Navigation. By Captain Basil Hall, R.N. F.R.S. Lond. and Edinb.

“There is no point in practical navigation of more importance than the allowance for the direction and velocity of currents ; and, although the introduction of time-keepers and lunar observations has led to much more accurate methods of making this estimate, yet there is unquestionably still much obscurity belonging to this branch of the subject : and, although it is scarcely to be hoped that we shall ever arrive at a correct knowledge of the laws which regulate the great streams of the ocean, we may certainly hope to approach much nearer than we are at present to the true state of the facts ; and that we shall eventually be able, in the practice of navigation, to make much juster allowance than we now do, for the influence of these powerful agents.

Probably much of the obscurity which belongs to this subject arises from the inaccurate way in which the tracks of ships, exposed to the influence of currents, have been laid down on our charts ; for the method most in use has this essential defect, namely, that on inspecting the chart of a preceding navigator, it is rarely possible to discover where any current began, where it ceased to act, what was its direction, or what its velocity ?—all essential points.

The mode proposed in this notice answers all these questions, and is quite as easy in practice as that in most general use. It is so obvious, that I cannot help being sure that it must have occurred to many practical navigators ; but as I have never met with it in any treatise on navigation, and have never seen a single chart in which the tracks were so laid down, I trust this notice will not be superfluous.

The common method is as follows :—The ship's place of each day, as estimated from the log-board, is noted on the chart ; and also the place, as deduced from chronometers and lunar observations. The first is called the place by dead reckoning, the other the true place. The line joining the true places at noon, is called the true track ; and that joining the others is called the track or course by dead reckoning. As it happens, invariably, that these two tracks separate very early in the voyage, and never afterward come together, unless by accident, it is obvious that, upon inspecting the chart, no information will be afforded as to the point where the current began, or where it ceased, or what was its set, or its velocity : all that we see is, two tracks wandering apart from one another ; and it always requires some calculation and measurement to come to any thing like an estimate of the true effect of the current.

The tracks laid down on some of Mr. Arrowsmith's maps of the Atlantic are, on this account, altogether useless, although inserted expressly to show the effect of the current. And I speak from experience when I say that, a chart marked in this manner, whatever attention may have been paid to it by the navigator, tends only to confuse, and not to instruct.

The method which is proposed to substitute is this : let the true place be laid down each day as before, either at noon, or, which is better, at the precise moments of observation for the longitude. *Let a fresh departure be taken from every such true place*, so noted in the chart ; and whenever a true place is marked on the chart, let the place, by dead reckoning at that moment, estimated by log-board from the last true place, be also noted down. From each true place let two lines be drawn, one to the next true place, and the other to the dead reckoning place at the same moment.

It will follow from this, that the true course of the ship will be one continued unbroken line ; but the dead reckoning course will be a series of terminated lines running off from the successive true places. The advantages of this method are these : In the first place, it will be evident that, as long as there is no current, the true and dead reckoning places will coincide, and there will be but one line on the chart ; but the instant that a current begins to act, the true and dead reckoning places will be different, and consequently the lines will separate ; and, whenever the current ceases, there will again be but one line. These distinctions catch the attention at once : but the plan has this farther great advantage, that the line joining the dead-reckoning place and the true place, at any given hour, will express correctly the direction and the set of the current, in the interval between the moment under consideration, and the instant of the last preceding observation.*

It is useful, in practice, to have the line expressing the true course distinguished in some way from those marking the dead-reckoning courses ; one may be a strong black line, the others dotted lines ; or, when a chart is much covered with tracks, it is useful to use differently-coloured lines.

It is sometimes satisfactory to join the dead-reckoning places and the true places by arrows, and then rub out the whole of the tracks ; so that all which is essential, as far as currents are concerned, is retained ; while all that is not, and which might tend to confuse, is removed.

When one or more days elapse without an observation, the dead-reckoning track may be carried on till an observation be obtained ; and then the dead-reckoning place and the true place at that instant being noted, a knowledge of the strength and direction of the current, during the interval, is at once afforded.†

It may be said that there is a fallacy in supposing the places, as laid down from chronometers and lunar observations, to be the true places : to which I would answer, that although it is not strictly the *true* place, it is generally not far from it ; and for all practical purposes, it may be so considered, because the object is, to ascertain the difference between the true path and the dead-reckoning path from day to day ; and it must be a very bad chronometer that will not give this within an inconsiderable quantity. Thus a chronometer, which might give the longitude half a degree wrong at the end of an Indian voyage, would serve very well to estimate the daily effect of the current off the Cape of Good Hope, within half a league of the truth.

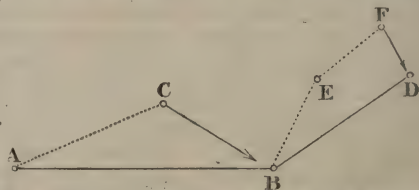
* EXAMPLE.—Let the ship's true place, on the first day, be assumed, as at A. Let a fresh departure be thence taken, and the next true place, or place by observation, be noted, as B. Let the ship's place by dead-reckoning be noted at the same moment, as at C.

From the true place, (A) let the two lines be drawn, as A B and A C.

The difference, C B, thus shows the error in dead-reckoning, which may be the effect of current.

From B, the ship's true place on the second day, the ship's true place on the fourth day may have changed to D ; while E represents her place by dead-reckoning on the third, and F on the fourth, day, &c.—EDITOR.

† This paper was originally communicated to the public through the medium of the '*Edinburgh Philosophical Journal*.' For a plate to illustrate the facts which it describes, see the Second Volume of that valuable Work, page 279.



It is clear that, to a ship navigating without a chronometer or lunars, the above method is of no avail: even if frequent lunar observations be taken, still it is not possible to make the required comparison, from day to day, without chances of great error; whereas, by means of a chronometer, (aided as it may very readily be by lunars,) nothing is so simple.

In this age of science, of general intelligence, and of liberality in every thing connected with mercantile enterprise, it is indeed most astonishing that any ship should ever be permitted to set out on a voyage without a chronometer: and owners of ships, independently of the fearful responsibility which they incur by neglecting so important a precaution, may be assured that they most materially neglect their own interest by this species of economy; for the safety of a ship is not only greatly lessened, but the voyage, in nine cases in ten, materially protracted by the want of this easy and cheap addition to her equipment. Not only, therefore, the high obligation which they are under, to preserve, as far as in them lies, the lives of people embarked in their service, but their own obvious pecuniary advantage, calls upon them to despise this paltry saving, and never to suffer one of their ships to leave port without being provided with an instrument often of as much value as either sails or rudder.

The class of navigators and ship-owners, who, not many years ago, held scientific navigation in contempt, is now happily much reduced. On such persons well-established facts have more influence than any general reasonings or assertions; and I beg leave to call their attention to the following circumstances, which actually fell under my own observation.

In May, 1815, in his Majesty's sloop *Victor*, I arrived off the Cape of Good-Hope, in company with a fleet of Indiamen, all of which were, of course, amply provided with excellent time-keepers. The *Arniston*, a large ship, and formerly an East-Indiaman, was also in company. She had been sent with troops to the Island of Ceylon, and was now returning with invalids, to the number of several hundred, together with upward of fifty women and children. From what circumstance, whether of ignorance, or mistaken and most culpable economy, I do not know, this ship was unprovided with a time-keeper, and therefore, though commanded by an active and intelligent seaman, she was not, owing to this single omission, at all in a condition to approach this coast, especially at such a stormy season, when lunar observations were scarcely to be hoped for, and when the current was most violent and irregular.

It was the daily practice to telegraph the longitude to the *Arniston*; and, so long as the fleet kept together, no disadvantage was experienced by her having no chronometer. But we had scarcely reached the eastern edge of the Bank of Agulhas, when a violent gale scattered the ships in different directions, and the unfortunate *Arniston* was left to shift for herself. The ships were exposed to a variety of currents, from the 18th to the 28th of May: in this interval we had, moreover, three heavy gales of wind; from which it will be obvious, that, by dead-reckoning alone, it was altogether impossible to tell the situation of the ship. In fact, on board the *Victor*, I found that, after making every allowance for currents, which the experience of others on this well-known ground entitled me to use, the dead-reckoning was still upward of 100 miles from the truth. But, after all, these observations are a mere guess.

Meanwhile, the commander of the *Arniston*, after making every possible allowance, conceived, at the end of ten or twelve days, that he must have passed to the *westward* of the Cape of Good Hope, by a very considerable distance, and without hesitation bore up with a south-easterly gale of wind, and steered, as he thought, for St. Helena. He had not proceeded, however, many hours, before the land was discovered a-head, and on each bow: they were embayed, in short, a hundred miles east of the Cape; and, though they let go their anchors, and cut away their masts, the gale drove them on the coast; and of the whole crew, soldiers, women, and children, only four or five sailors reached the shore alive! *

In order to prove that this ship was lost from want of a time-keeper, it is only necessary to state the following facts, which will be conclusive with every practical navigator.

By means of good time-keepers, I found that his Majesty's sloop *Victor*, during the interval above-mentioned, was carried by the current 186 miles to the westward, and 72

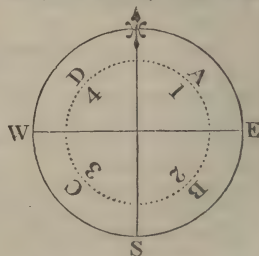
* It has been asked, by an intelligent friend, whether, by *sounding* in time, the *Arniston* might not have been saved? It seems probable that she might.

miles to the eastward, making an aggregate of 114 miles, or $2^{\circ} 18'$ of westing more than the dead-reckoning. Now, it would have been a moderate allowance for the effect of the Cape current, under all the circumstances of the case, to have supposed the ship to be set to the westward in eleven days at least 220 miles, or 106 miles more than the ship was actually set: so that, after the commander of the *Arniston* had made all the usual allowances, he would still have estimated his place wrongly, by at least 106 miles, or $2^{\circ} 8'$ of longitude; an error five times greater than the worst chronometer I have ever seen in use, would have given in so short an interval. It thus becomes certain that, when the *Arniston* was, by dead-reckoning, after full allowance had been made for current, apparently many miles west of the Cape, she was in fact a very long way east of it. And the important circumstance to be borne in mind is, that, had this ship been provided with a very ordinary chronometer, she would, according to every principle of navigation, most assuredly not have been wrecked."

VI.—BRIEF MODE OF EXPRESSING THE POINTS OF THE COMPASS.

The Spanish navigators, in describing courses, &c., commonly make use of the expression, '*Rhombs of the first, second, third, and fourth, quadrant,*' or winds of the same. The first quadrant, in this expression, is that contained between *North* and *East*; the second, from *East* to *South*; the third, from *South* to *West*; and, the fourth, from *West* to *North*.

The respective quadrants may be represented algebraically by the letters A, B, C, D, as in the annexed figure: and, in keeping a journal, the points of the compass, or courses and bearings, may be expressed briefly, by adopting these letters as the representatives of the four quadrants: thus, N.W. by W. $\frac{3}{4}$ W., or five points and three-quarters from the North toward the West, will be concisely expressed by D $5\frac{3}{4}$; N.E. will be A 4; S.E. by E, B 5; and S.W. by S, C 3; &c.



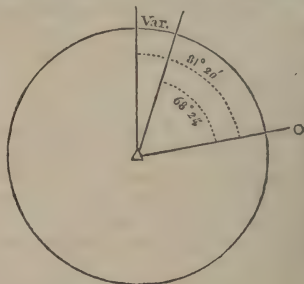
So, likewise, by reckoning in degrees of the quadrant, N. 50° E. will be A 50° ; and, in allowing for magnetic variation, say 24° W.; this added will be A 74° , the compass bearing, &c. Should a true bearing be N. 76° E., adding 24° the variation, will give 100° : deduct 90° , and this gives E. 10° S. or S. 80° E., or B 80° , the bearing by compass.

But, that the figures for Points may never be mistaken for degrees, it may, perhaps, be best to express the latter in the usual manner, as N. 50° E.

VARIATION OF THE COMPASS BY PROJECTION.

The readiest way of understanding this subject is to project every azimuth and amplitude when it is taken. If this be done properly, no confusion will remain, after a few observations. An example will best illustrate this.

Say, Latitude $0^{\circ} 38' \text{ N.}$ Declination $21^{\circ} 32' \text{ N.}$ Magnetic Azimuth, E. $81^{\circ} 20' \text{ N.}$ True Azimuth, E. $68^{\circ} 24' \text{ N.}$ In the first place assume a point Δ , which call the observer's eye; and another O, which call the sun: join these two, and from the eye, as the angular point, lay off the magnetic azimuth, = $81^{\circ} 20'$; then, from the same line, Δ and O, and from the eye Δ , lay off the true azimuth = $68^{\circ} 24'$, the difference of these two angles is the Variation, = $12^{\circ} 56'$.



VII.—GENERAL REMARKS ON THE MAGNETIC VARIATION AND ABERRATION.

IN order that the subsequent Remarks may be clearly understood by every one of our readers, it becomes necessary to explain, in the first instance, the meaning of *magnetic dip*, or *dip of the needle*.

The **DIP OF THE NEEDLE** is a certain degree of inclination, toward the earth, which it acquires with the magnetic virtue. This wonderful property was first observed by our countryman, Robert Norman, a maker of compasses, about the close of the sixteenth century; and instruments have since been constructed for ascertaining the inclination, or quantity of *dip*, in different parts of the earth.

The general phenomena of the *Dipping Needle* are, that, at a certain distance from the equator, either north or south, it varies but little from an horizontal position, but depresses one end on receding either way from that parallel; the north end when nearer to the north pole, and the south end when nearer to the south pole: so that the farther north or south that we go, the inclination becomes the greater. At London, in the year 1592, the dip of the north end of the needle was given as $71^{\circ} 50'$ below the horizon; in the year 1805, as $70^{\circ} 21'$. At Paris, in 1812, it was $68^{\circ} 42'$.*

The extreme delicacy of the instrument employed, and the great care requisite in taking the observations, have impeded our knowledge of the exact dip in different parts of the earth: but the following are the results of some of the best observations that have been made on the face of the Atlantic, &c.

In Baffin's Bay	Lat. $76^{\circ} 8'$	Dip, $86^{\circ} 0'$	S. Voyage of Capt. John Ross, 1818.
Spitzbergen	$79^{\circ} 45'$	$82^{\circ} 0'$	— Voyage of Capt. Buchan, 1818.
London	$51^{\circ} 30'$	$70^{\circ} 21'$	— Royal Society, 1805.
Paris	$48^{\circ} 50'$	$68^{\circ} 42'$	— Institute of France, 1812.

Atlantic Ocean.

In Lat.	38°	52°	N. Long.	14°	2°	W. Dip,	45°	$45'$
	37	26	—	14	12	—	45	21
	34	30	—	14	35	—	43	48
	31	46	—	14	44	—	43	30
	28	28	—	16	13	—	41	45
	24	53	—	18	38	—	40	48
	21	29	—	23	22	—	39	3
	19	54	—	26	25	—	38	19
	14	15	—	45	43	—	33	54
	13	2	—	50	55	—	30	40
	11	1	—	52	31	—	28	15
	10	46	—	58	34	—	28	9
	11	2	—	19	38	—	20	0
	0	50	—	15	11	—	18	0
	0	11	—	16	13	—	17	0
	0	42	S.	16	52	—	17	0
	1	43	—	17	21	—	16	0
	5	37	—	19	22	—	10	30
	6	50	—	19	52	—	8	30
	8	5	—	20	41	—	7	0
	9	26	—	21	19	—	3	30
	10	57	—	23	0	—	0	0

Rob. Buca

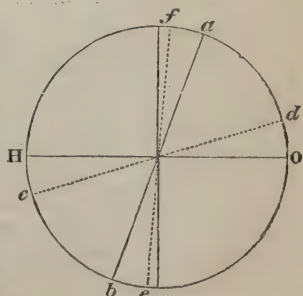
The Baron von Humboldt, on his Voyage of 1799. For particulars see his *Personal Narrative*, English translation, Vol. II. p. 117.

Ship *Boussole*, under M. de la Pérouse, 1785: but those of the *Astrolabe*, under the same commander, varied from these very considerably.

In the diagram annexed, H O represents the horizon; *a, b*, the magnetic dip at London, 70° ; *c, d*, that on the equator, 17° ; and *e, f*, that in Baffin's Bay, equal to 86° nearly.

We give the preceding table, &c., merely to illustrate the definition. Few merchant-ships have a Dipping-Needle, and the commanders of those which have, will seek for information on this subject in other sources. We, therefore, turn to the *Variation* of the Compass.

The present state of the magnetic variation has become a subject of peculiar and curious inquiry to the navigator and philosopher. We have shown, in a former work, the "Sailing Directions which accompany the Chart of the



* The *Magnetic Pole*, or point of meeting of the magnetic curves, where the needle is perpendicular, according to Captain James Ross, 1831, is in or near latitude $70^{\circ} 15'$ N. and long. $90\frac{1}{2}^{\circ}$ W.

English Channel," the state of the Variation at London, as ascertained at different periods, from the year 1580, when it was $11^{\circ} 15'$ East, to the middle of 1824, when it was $24^{\circ} 9' 33''$ West; and, in another work, "the Memoir to accompany the General Chart of the Northern Ocean," &c., we have shown its recent state around the Coasts of Great Britain, and on those of the Greenland Seas, Baffin's Bay, Hudson's Bay, &c.

Should, however, the reader of this work not have those above mentioned to refer to, it may be necessary to repeat a few remarks already made; and it is, of course, requisite to add such others as are peculiarly adapted to the navigation of the Atlantic.

The existing variations of the needle, on the different coasts of this sea, may be readily known by referring to the last paragraph of Notes, attached to the respective divisions of the Tables of Positions, in the former part of this work. We have also shown, upon the face of the Chart, the variation on the ocean, remote from land; and, although many of the observations were made some years ago, there is reason for believing that they deviate but very little from the truth at the present time.*

It is now well known, from many observations made at London, Petersburg, St. Helena, and other places, that the magnetic needle has a diurnal, as well as an annual, variation: and that, from about eight o'clock in the morning, the magnetic needle verges to the West, until about two o'clock in the afternoon. When it has attained its greatest westerly variation, it gradually returns to the east, until about eight or nine o'clock in the evening, when it becomes stationary until the next morning. Thus, in the most regular state of the magnetic needle, it is constantly subject to two variations, an annual and a diurnal one; and it is also subject to an *aberration*, arising from the state of the atmosphere, humidity, lightning, local attraction, &c.

The westerly variation appears to have been decreasing for many years past in Canada and the Northern parts of the United States of America; but, in the West Indies, there seems to have been but little change for a long period; and it appears to be, at length, determined, that the westerly variation has reached its maximum in Europe, and is now on the decrease.

From a series of astronomic and magnetic observations, made by *Colonel Mark Beaufoy*, at Hackney Wick, near London, (on the East,) in May, 1813, the greatest variation was observed, on the 3d of that month, and appeared to be $24^{\circ} 26' 20''$. At 8h. 50m. in the morning of that day, it was only $24^{\circ} 9' 45''$, and continued to increase until 35 minutes past two; at which time there was a *great deal of thunder in the west*; but, on the next day, when there was thunder in the East, the variation amounted only to $24^{\circ} 16' 30''$, the difference being $9' 50''$.

The mean of the morning, noon, and evening, observations, taken by the same ingenious officer, on fifteen days of the same month, was as follows:—*Morning*, $24^{\circ} 11' 15''$; *Noon*, $24^{\circ} 20' 55''$; *Evening*, $24^{\circ} 15' 54''$. The latter may be considered as near the general mean. The mean variation, at the three periods of observing, for two years, 1814 and 1815, has been given as follows.—*Morning*, $24^{\circ} 14' 39''$; *Noon*, $24^{\circ} 21' 54''$; *Evening*, $24^{\circ} 16' 4\frac{1}{2}''$.

The observations of Colonel Beaufoy were continued nearly to the time of his decease;

* We have had reason to wish that our Notes on the Variation had been more generally known. In a respectable Review of Books, which has long been celebrated for its general display of knowledge and liberal opinions, we find the following passage, written in the year 1820. "According to a Chart of the Variations, by Bellin, a very celebrated engineer, the needle continues stedfast at 20° of westerly variation during the whole of a direct course from Bristol, across the Atlantic, to Boston, in North-America; a distance of about 4800 miles: but, in the minor distance from Boston to Cape Florida, about 1100 miles, a variation of 23° occurs." A reference to our Tables will show that the present variation at or near Bristol is not less than 25° West; at St. John's, Newfoundland, 26° West; but, at Boston, only 7° West; and, at Cape Florida, about 5° East. The latter, it is to be recollected, are not deduced from any theory or hypothesis, but from actual observations.

In connexion with this subject, the following remarks have been made by our friend *Lieut. W. H. Brady*. "In merchant-ships, in which I have latterly sailed, transports included, I have noticed that observations for the magnetic variation are seldom made; nor are azimuth compasses often supplied. This neglect is not excused by the superior methods that are getting into general use for ascertaining a ship's place: because a variety of circumstances daily occur which may render it necessary to have recourse to a reckoning by account, of which the variation forms a most important element, and many charts are blind guides in this particular."

and his statement, August, 1817, to October, 1819, may be seen in our "*Memoir on the Northern Ocean*," page 3. A subsequent statement to March, 1820, follows:—

		1818.			1819.			1820.		
		°	'	"	°	'	"	°	'	"
November.	Morning..	24	33	24	24	32	42	0		
	Noon	24	41	41	24	38	43			
	Evening ..	—	—	—	—	—	—			
December.	Morning..	24	37	4	24	33	29			
	Noon	24	41	20	24	37	20			
	Evening ..	—	—	—	—	—	—			
January.	Morning..	24	34	2	24	35	42	24	34	6
	Noon	24	39	57	24	39	54	24	37	54
	Evening ..	—	—	—	—	—	—	—	—	—
February.	Morning..	24	34	22	24	34	17	24	32	19
	Noon	24	40	51	24	39	55	24	38	7
	Evening ..	—	—	—	—	—	—	—	—	—
March.	Morning..	24	33	18	24	33	18	24	30	47
	Noon	24	41	37	24	41	42	24	39	33
	Evening ..	24	33	47	24	35	17	24	33	45

The mean variation, in the month of September, 1820, as found by Colonel Beaufoy, was, *Morning*, $24^{\circ} 31' 16''$; *Noon*, $24^{\circ} 40' 29''$; *Evening*, $24^{\circ} 32' 59''$.

These observations were made at Bushy Heath, Stanmore, about ten miles N.W. from London, where it appears that the maximum of western variation occurred about the month of March, 1819, since which time it has decreased. Colonel Beaufoy adds, "It is on record that, in 1658, the compass pointed to the true north: the western variation has, therefore, been increasing for 162 years, and is now retrograde; but what is the limit of the eastern declination, remains to be determined; as I cannot find any observations on the variation of the compass prior to 1580, at which time it was $11^{\circ} 15'$ East." From observations made by the Royal Society, at Somerset Place, in London, in 1821, the mean variation here appeared to be only $24^{\circ} 11' 18''$; in 1822, $24^{\circ} 9' 55''$; in 1823, $24^{\circ} 9' 48''$; in 1824 (to Midsummer), $24^{\circ} 9' 33''$. In 1834 it appeared to be under 24 degrees.

The ABERRATION of the COMPASS is its deviation from the magnetic meridian, which may be caused, as already noticed, from a peculiar state of the atmosphere, aurora-borealis, lightning, or the local attraction of the ship, iron, &c. The *aberration* is a new subject of inquiry, which was first explained by Captain Flinders, in the description of his Surveys on the Australian coast. To this subject his attention was directed, not only by some anomalous differences which he found in the compasses that he used, but by others recorded by Mr. Wales, who had accompanied Captain Cook in the capacity of Astronomer.

Mr. Wales, in the Introduction to his Astronomical Tables, at the end of the voyage, remarks, "In the English Channel, the extremes of the observed variation were from $19\frac{1}{2}^{\circ}$ to 25° ; and, all the way to the Cape of Good Hope, I frequently observed differences nearly as great, without being able any way to account for them, *the difference in the situation being by no means sufficient*. These irregularities continued after leaving the Cape, which at length put me on examining into the circumstances under which they were made. In the examination, it soon appeared that, when most of these observations were made, wherein the greatest west variation had happened, *the ship's head was north and easterly*; and that, when those, where it was least, had been observed, it was *south and westerly*. I mentioned this to Captain Cook and some of the officers, who did not, at first, seem to think much of it; but, as opportunities happened, some observations were made under those circumstances, and very much contributed to confirm my suspicions; and, throughout the whole voyage, I had reason to believe that, variations observed with the *ship's head in different positions, and even in different parts of her, will differ very materially from one another*; and much more will observations, observed on board different ships, which I now find fully verified, on comparing those made on board the Adventure, with my own made about the same time in the Resolution."

Captain Flinders says, "Several instances have been mentioned, in the course of this voyage, where the compass showed a different variation on being removed from one part of the ship to another; thus, observations on the binnacle gave $29\frac{1}{2}^{\circ}$ off the Star, where the true variation was about $25\frac{1}{2}^{\circ}$ West; while others taken upon the booms, before the mainmast, 68 miles lower down Channel, gave only 24° ; and, in experiments made with five compasses,

compasses, the mean variation at the binnacle was $4^{\circ} 37'$ greater than on the booms. Finding that the situation of the compass was an object of importance, I determined very early in the voyage to place it always upon the binnacle, both when taking bearings for the survey, and when observing azimuths or amplitudes; nor, in any observations taken by myself, was it ever displaced except by way of experiment: but the officers occasionally observed from different parts of the ship, when the sun could not be seen from the binnacle, until they were convinced that such observations were of no utility, either to the survey, or for ascertaining the true variation.

It soon became evident, however, that keeping the compass to one spot was not sufficient alone to insure accuracy; a change in the direction of the ship's head was also found to make a difference in the needle; and it was necessary to ascertain the nature and proportional quantity of this difference before a remedy could be applied. This inquiry was attended with many difficulties, and no satisfactory conclusion could be drawn until a great variety of observations were collected: it then appeared that, when the ship's head was on the eastern side of the meridian, the differences were mostly one way, and when on the western side they were the contrary; whence I judged that the iron in the ship had an attraction on the needle, and drew it forward; but there was this remarkable distinction, in the northern hemisphere, it was the north end of the needle which was attracted, and, in the southern hemisphere, it was the south end. In the instance off the Start, before cited, when the ship's head was West, the north end of the needle had been drawn forward, or to the left of North, nearly 4 degrees, and the West variation thereby increased to $29\frac{1}{2}^{\circ}$; with the head East, it would be drawn to the right of its natural position, and the variation diminished to about $21\frac{1}{2}^{\circ}$; but, at North, the attraction in the ship was in the same line with the magnetic poles of the earth, and would therefore produce no change. The same thing took place at South, for the two attractions were still in the same continued line, though on opposite sides of the compass; and, throughout the voyage, I found that variations taken with the head at North and South, agreed very nearly in themselves, and with the observations on shore, near the same place, when such observations were not affected by local attractions.

But, although the errors were always the same way in the same hemisphere when the head was at West, and when it was East they were always the contrary, yet the quantities varied with the situation of the ship, being greater in high and less in low latitudes; and yet they did not increase and diminish in proportion to the latitude. After much examination and comparison of the observations, and some thinking on the subject, I found that the errors had a close connexion with the *dip of the needle*. When the North end of the needle had dipped, it was the North point of the compass which had been attracted by the iron in the ship; and, as that dip diminished, so had the attraction, until, at the magnetic equator, where the dipping-needle stands horizontal, there seemed to be no attraction. After passing some distance into the southern hemisphere, and the south end of the needle dipped, our observations again showed errors in the compass; but the West variation was now too great when the ship's head was eastward. These errors increased as the dip augmented: and, in Bass' Strait, where the South dip is nearly as great as the North dip in the English channel, the attraction produced almost as much error as when we left England; but it was of an opposite nature. On turning northward again, along the East coast of New South Wales, the dip of the South end of the needle, and the attraction of the iron upon the South point of the compass, diminished together, as nearly in equal proportions as the accuracy of our observed variations could be depended on; and I, therefore, considered the connexion between them to be so far certain, as to make the dip one *datum* in reducing the observed to the true variations.

Another point of equal importance remained to be known: the compass stood right in both hemispheres when the ship's head was at North or South, and erred most to one side when the head was West, and on the other when it was at East; but what was the proportion at the intermediate points, between the magnetic meridian and East and West? Unfortunately, the direction of the ship's head, when observations were taken, had not been particularly marked in the first part of the voyage, nor always in the latter part; and, in gathering it from the courses steered, when under way, and from the direction of the winds and tides when at anchor, there was often a good deal of uncertainty; but, it was evident that, the quantity of error increased as the angle between the ship's head and the magnetic meridian became greater. After some consideration, it appeared to me, that the magnetism of the earth, and the attraction forward in the ship, must act upon the needle in the nature of a compound force; and that the errors produced by attraction should be proportionate to the

the *sines* of the angles between the ship's head, and the magnetic meridian. I tried this upon many observations, where the direction of the head was least doubtful, and found the differences to correspond as nearly as could be expected, and sometimes exactly; it, therefore, seemed probable that *the error produced, at any direction of the ship's head, would be to the error at East or West, at the same dip, as the sine of the angle between the ship's head and magnetic meridian, was to the sine of eight points, or radius.* According to this, when the error was ascertained at any given direction, more especially at East or West, where it was greatest, it might be found at any direction required, by inspection in the Traverse Table.

Soon after my arrival in England, application was made to the Lords Commissioners of the Admiralty to have experiments tried on board some of his Majesty's ships, that this law might be verified; and they were pleased to order them at Sheerness, Portsmouth, and Plymouth. I was present at the first two ports, when a series of observations were made in five different vessels; and the general results, so far as they are necessary to the present explanation, were these:—

1st. At or near the binnacle, the north point of the compass was attracted forward in all the ships; but the quantity of error produced on one side when the head was East, and on the other when West, varied from $6\frac{1}{2}^{\circ}$ to $0^{\circ} 21'$.

2d. When the compass was placed in other parts of the different ships, the attraction was sometimes forward, and sometimes aft; but always aft from the forecastle. The error at some of the stations was greater than at the binnacle, and at others less.

3d. The errors were least when the ship's head was at, or near to, North or South, and greatest at, or near to, East or West; and, as the head was made to deviate from the points of least error toward the greatest, the increase of error was found to be in proportion to the sines of the angles of deviation [aberration].

The last was the particular subject of my anxiety; and, being then satisfied that the law, before deduced from analogy, was certain, I employed it to find a standard correction for all my observations in the *Investigator*. For this purpose a selection of them was made where the ship's head was in the most opposite points, and farthest from the meridian, and where the true variation could be ascertained within a small quantity; the difference between the observed and true variations gave the errors; and, when the head had not been East or West, they were proportioned to eight points or radii, by the sines of the angles. These observations were collected into Tables, one for the northern, and another for the southern, magnetic hemisphere, and classed according to the dips of the needle; and the error, for eight points, at each dip, being reduced to parts of that dip, a medium of the whole was taken, and considered to be the standard radius applicable to all situations.—*Flinders' Appendix*, vol. ii. 512 to 515.

Captain Flinders notices the preceding remarks made by Mr. Wales, and he adds, "Mr. Wales did not quit the subject here. In the Introduction to Captain Cook's Third Voyage, published in 1785, is a paper from the same careful observer, citing a variety of cases wherein differences were found in the variation of the compass. These cases are as follow:—

"1st. Putting the ship's head a contrary way: differences 3° to 6° , and even 10° .

"2d. At different times of the same day: differences 3° to 7° .

"3d. Being under sail, and at anchor in a roadstead: difference 5° .

"4th. On board different ships: differences 3° to 5° .

"5th. Near the same place, at different times in the voyage: 4° and 5° , or upward.

"6th. In different compasses: 3° to 6° .

"That the variation should be different on changing the direction of the ship's head, or the place of the compass, and also on board different ships, is perfectly reconcileable to the explanation I have given; but that it should vary so much at different times of the same day or year, when under sail and at anchor, or even in different compasses, much surprised me, if all other circumstances were the same. I was, therefore, induced to examine the instances quoted under each case; and found great reason to believe, not only that the direction of the head was changed in most, if not all of those where great differences had been observed; but, also, that the differences themselves were conformable to what had taken place upon the binnacle of the *Investigator*.

"Mr. Wales goes on to observe, 'It is not necessary to account for these differences in the observed variations in this place, nor yet to point out the reasons why such anomalies have not been noticed in observations of this kind before. I shall, however, remark that I have hinted at some of the causes in my introduction to the observations which were made in Captain Cook's Second Voyage; and many others will readily offer themselves to persons who have had much practice in making these observations, and who have attentively considered the principles upon which the instruments are constructed, and the manner in which they are fabricated. Nor is it at all surprising that the errors to which the instruments and observations of this kind are liable, should not have been discovered before; since no navigators before us ever gave the same opportunity, by multiplying their observations, and making them under such a variety of circumstances as we did.'

"That the compasses, even in the Royal Navy, and to this day, are the worst constructed instruments of any carried to sea, and often kept in a way to deteriorate, rather than to improve, their magnetism, cannot be denied; but errors, arising from the badness of compasses, would not be reducible to regular laws, as those were in the Investigator, and appeared to be in the three ships commanded by Capt. Cook. It seems, indeed, extraordinary that, with the attention paid by Mr. Wales to the subject, he should not have discovered, or suspected, that the attraction of the iron in the ship was the primary and general cause of the differences so frequently observed; nor have perceived that the differences varied proportionally to the direction of the ship's head and to the dip of the needle, and were of an opposite nature in the two hemispheres.

"It appears that differences, probably similar to those in the Investigator, were also observed on board *La Recherche*, one of the ships with which the French Admiral d'Entrecasteaux went in search of the unfortunate *La Pérouse*. M. Beautemps-Beaupré, the able surveyor to the expedition, found so much uncertainty in compass-bearings, that he abandoned, as far as was possible, the use of them; substituting the sun's azimuth and angular distances from some one point, and measuring the angles from that point to other objects. He says of the compass, 'We found, by a great number of observations, but principally by the differences between the bearings of points set with each other from opposite directions, that no confidence could be had in bearings taken with the compass from the deck of a large vessel, nearer than to 3° , even under the most favourable circumstances. For instance, it has often happened that, from one position, as C, the cape A has been set in a line with cape B; and, afterward, from another position, D, cape B has been set with A; and that we have found considerable differences in the results of the two observations.* We also remarked that the compasses showed differences of several degrees in variations at sea, though observed with the greatest care and within the space of a few minutes.'

"I do not find any other distinct mention of differences found in the variation from changing the direction of the ship's head, or the place of the compass; but it appears from the following extract that the Investigator was not singular in having a variation of four degrees greater than the truth in the English Channel. Captain Vancouver, in his passage toward Madeira, says (Vol. I. p. 6,) 'The error in reckoning, amounting almost to a degree (of longitude,) seemed most likely to have been occasioned by our not having made sufficient allowance for the variation of the compass on our first sailing; as, instead of allowing from 22° to 25° , which was what we esteemed the variation, our observations for ascertaining this fact, when the ship was sufficiently steady, showed the variation to be 28° and $29\frac{1}{2}^{\circ}$ westwardly.

"Besides the errors which the attraction of the iron produced in the compasses at the binnacle of the Investigator, differences are frequently mentioned in the course of this voyage as having been found in the magnetic needle on shore, and on board the ship in the vicinity of land. That there are few masses of stone totally devoid of iron; and that all iron, which has long remained in the same position, will acquire magnetism, or a power of attracting one end of the magnetic needle toward one part of it, and the opposite end toward another, is, I believe, generally admitted. The kinds of stone which I have observed to exert the greatest influence on the needle, are iron ore, porphyry, granite, and basaltes; and the least are, sand or free-stone and calcareous rock, and the argillaceous earth, very little."—*Flinders' Appendix*, vol. ii. 523 to 526.

* In the sketch given for elucidation, the ship, at the position C, is represented to be steering S.W., and, at the position D, N. by E.; hence, probably, the difference of bearing.

DEDUCTIONS FROM THE EXPERIMENTS *made by* CAPTAIN FLINDERS.

1st. On board most ships, more especially of war, the iron-work, guns, shot, &c. possess magnetic powers; out of which a compass cannot be placed any where within the ship; and, if it is placed at a short distance out of the ship, the effect upon it will be even greater than in most parts on board.

2d. In England, and probably in all parts of the northern magnetic hemisphere, the effect of these various influences is, generally, to draw the North point of the needle toward the bodies whence the influences emanate, and to repulse the South point from them.

3d. The power of each body to alter the direction of the needle depends upon the four following particulars: First, the strength of the magnetic virtue in that body. Second, its direction, with respect to the horizontal level in which the needle traverses. Third, its distance from the compass: and, fourth, the angle which its bearing makes with the magnetic meridian. Of these, the last three may be changed, by altering the place of the compass, without any motion of the ship, and the last may be changed by altering the direction of the ship's head.

4th. The effect produced upon the compass is the combined result of all the attractions in the ship. If those in one direction be superior to the others, the needle will be drawn in that way. If those in two directions be superior to all others, but equal in themselves, the needle will be drawn toward a line passing between them; but, if the attractions be equal in all directions, it will suffer no derangement, but remain in the magnetic meridian.

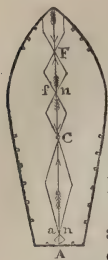
5th. Were all the iron in a ship confined to the sides, and equally distributed, a needle in the midship line would be always attracted forward when placed abaft the centre; and always attracted aft, when before the centre. But there are three parts, more particularly, where considerable quantities of iron are placed in or near the midship line; and these interfere with the lateral attractions, by counteracting their combined effect in some situations of the compass, and strengthening it in others. About the stern, bows, foremast, and under the forecastle, there is much iron near the midship line, and some round the mainmast. Toward one of these three situations, if the lateral attractions be equal, a needle in the midship line will always tend, with some exceptions. For the advantage of explanation, call the three attracting situations, individually, the *foremost*, *central*, and *aftermost*, attractions; and, generally, the *midship attractions*. The intermediate stations, where these attractions neutralize each other, call *neutral stations*.

6th. When the midship attractions and the lateral attractions are equal, there will be no alteration made in the needle at any part of the midship line, when the ship's head is in the magnetic meridian, either at North or South. These are then the *points of no difference*: but, if the midship attractions lie to either side, or the lateral attractions be unequal, the points of no difference will not be at North or South, but at those directions where the head must be, to bring the mean of the attractions to lie North or South from the compass. Thus, if the mean attraction lie forward 10° from the midship line to the starboard side, the points of no difference will be N. 10° W. and S. 10° E. when the attraction will lie in the magnetic meridian, and no change be produced in the needle. And, if the attraction lie aft, 10° over to the same side, the points of no difference will be N. 10° E. and S. 10° W.

7th. The directions of the ship's head, at which the greatest differences will be produced by the attraction of the ship, are at right angles to the points of no difference. At the intermediate points, the differences will be proportionate to the greatest difference, as is the *sine of the angle of deviation from the points of no difference, to radius*.

8th. The stations most important to be known are the *neutral stations*; where the needle, being equally affected by the attractions forward and aft, remains true. The foremost station usually lies at a little more than half-way from the main, toward the fore, mast; and the aftermost neutral station very close to the stern.

9th. *Neither the exact places of the midship attractions, nor of the neutral stations, can be known without experiment made in each ship*: nor otherwise can it be known what are the points of no difference; what will be the greatest difference; nor even, which way the needle will be certainly attracted: so varied is the magnetism in different vessels. The points of no difference, however, are most usually North and South, or very near them. The annexed small figure will show the most regular course of the attractions on the upper deck of a ship of war.



F. The foremost attraction near the foremast.

C. The central attraction near the mainmast.

A. The aftermost attraction close to the stern.

f. n. The foremost neutral station.

a. n. The aftermost neutral station. The arrows show the attraction forward, or aft: and the diamond-like squares show the relative quantity of difference produced in the needle along the midship's line.

10th. The mean of two bearings, or variations taken with the ship's head at any two opposite directions, or at any equal number of degrees from the points of no difference, will be the correct bearing or variation, so far as the compass can be depended on, and the observations are well taken.

11th. The strength of the magnetic virtue in the iron on board a ship depends upon the situation of the ship, with respect to the magnetic poles of the earth. Thus, when the ship is nearest to the North Pole, the iron, in general, attracts the North end of the needle; and the more strongly, as the ship approaches nearer the pole. When the ship is in the southern magnetic hemisphere, the iron attracts the South end of the needle; and the degree of its strength is proportionate to the greater vicinity of the ship to this pole, than to that of the opposite hemisphere. At the magnetic equator, where the difference of the two poles is equal, or nearly so, and their powers balanced, the iron does not attract either end of the needle in preference.

12th. The dip of the needle being produced by the same cause which gives magnetism to the iron in a ship, will serve as a measure for the relative force of that magnetism, and for the differences produced by it in a compass at different parts of the earth. Thus, in changing a ship's head from North to East, if a difference of 4° to the right is found in the English Channel, where the dip is about 72° N. At another place, where the dip is 36° N., the difference, from an equal change in the head, should be 2° the same way, provided the place of the compass be the same, and the iron be unchanged. At 36° dip of the South end of the needle, the difference should also be 2° , under the same circumstances; but to the left instead of the right.

Mr. Bain, in his "*Essay on the Variation of the Compass*,"* has added many observations to those of Captain Flinders, and has examined the fatal consequence that must, at times, arise to navigators who neglect so important a datum in their reckoning as that which is here pointed out; and which, according to the author's observations, made with the greatest care and attention, will amount, in many cases, to 10 or 12 degrees: that is, the variation of the compass, with the ship's head at East, will appear to be 22° or 23° ; and, with the ship's head at West, the variation will be found 32° or 33° : so that, on either of these courses, the ship will be steering 5° too much to the East or to the West. The fatal consequence that may ensue from such an error in the reckoning will be sufficiently obvious.

Captain Ross, in his voyage to Baffin's Bay, has given some striking illustrations of the aberration of the compass. This gentleman says that, when the variation is great, the aberration, which is *more or less in every ship*, will increase in no *settled* proportion, but will be governed by so many causes, that no surer method of ascertaining the course really steered can be adopted than that of determining the actual variation of the time, according to the course in which the ship is steered.

In alluding to the origin of observations on the Aberration, Captain Ross observes, that it was reserved for Captain Flinders to elucidate this interesting fact; "to lay down a rule for correcting the error of variation, occasioned by changing the ship's head, which, under the circumstances, and within the limits of his observation and experience, were probably legitimate and correct. But the principle on which this rule is founded, will *not be found applicable to every circumstance*, and to all situations, and particularly where it has now been put to the test, in Baffin's Bay. He adds that, the experiments made after the return of Captain Flinders, gave *some insight* into the cause of aberration, but were insufficient to explain them perfectly; and this Captain Ross has most fully proved by his experience on the voyage, during which, every possible opportunity was embraced, by taking observations, and making all the necessary experiments and comparisons.

* See our '*Memoir on the Northern Ocean*,' &c., page 4.

The enormous quantity of Variation and Aberration found in the Northern Seas, is described in our Memoir on the Northern Ocean, pages 6 and 7. Captain Ross's deductions, from various experiments, are as follow :—

1st, That there is a *point of change** in the aberration, occasioned by the attraction of the ship.

2d, That the point of change is not the magnetic north, but *near* it, in the ship *Isabella*.

3d, That it varies in different ships, and is affected by increase or decrease of variation, by proximity to land, or to another ship.

4th, That the point of change may be found by azimuth, or by the bearing of a distant object, situated near the magnetic north, or in any other direction, if that cannot be had.

The rule, therefore, is,

Take an azimuth, or the bearing of a very distant object by the azimuth compass, with the ship's head at different points, East and West of North, until the points of least and greatest aberration are found; the mean of these will be, nearly, the point of change.

The several facts collected from all the experiments made at different times during the Expedition to Baffin's Bay, 1818, were as follow :

1. That every ship has an individual attraction, which affects the compasses on board her; and, to ascertain the exact quantity of its effect, though possible, requires the most particular care and the nicest attention.

2. The effect of this attraction being different in different ships, and not progressive always, but often irregular, no general calculation will therefore apply in the case of all ships, to ascertain it for the purpose of correction; and, consequently, all the rules hitherto given for obtaining it, particularly in arctic climates, cannot be relied on.

3. As six compasses were compared with each other on board the *Isabella*, and found to agree in the *same* place, and all to disagree, when placed in different situations between the stern and foremast, it is evident that the aberration in any ship will vary, according to the station of the compass at the time of using it; and, therefore, as the point of change will not be the same at every part of the ship, all observations must be made in one and the same place, where the point of change has been obtained, and to which only that point of change will apply.

4. The aberration does not always continue the same under the same apparent circumstances, and varies according to the point the ship's head is on.

5. The aberration appeared to be materially affected by heat and cold, as well as by atmospheric humidity and density.

6. The direction of the wind seems to have an irregular effect on the aberration.

7. The dip, also, has an irregular effect on the aberration.

8. That the points of change found with the compass, in the same part of the ship, will remain the same, unless some material alteration is made in the stowage of metallic substances on board; yet the *amount* of aberration, with the ship's head on any point of the compass, will be in a proportion, though not a regular one, with the increase or decrease of the variation and dip; by both of which, the aberration appears, in some degree, to be governed, though not the points of its change, they seeming to be independent of any influence but the ship's attraction or magnetism; and which is not of *equal* force in every part of the same ship, nor, perhaps, alike in any two. It is, however, presumed that, the experiments and observations that have been made, and the rules proposed and exemplified, will be sufficient to correct the errors in the mariner's course, which have so often proved fatal, and hitherto been attributed, perhaps, to defects in compasses, to currents, and other unaccountable causes.

CAPTAIN ROSS'S RULES for FINDING the POINT of CHANGE in ABERRATION, are as follow :—

RULE 1.—To find the Point of Change.

LET the bearing of one distant object, or the transit of two distant objects, (whose *true* bearing from the ship, or from each other, is known,) be taken, with the ship's head at

* The POINT of CHANGE is the point on which there is the least deviation, or *aberration*, from the correct magnetic bearing.

several points of the compass ; if they all agree, the ship has no aberration ; but, if not, the *one* which is found to *agree* is the point of change.

RULE 2.—*To find the Aberration for the Point steered.*

LET the bearing of the same object be taken with the ship's head on the point of the course steered ; and add, or subtract, the differences between them as it increases, or decreases, the variation.

To find the aberration at sea, when a distant object is in view, whose true magnetic bearing is not known :—Let a boat be sent out of the ship's attraction to take the bearing of the object, and then the bearing of it is to be taken from the ship, in the manner before described. But, even when no distant object is in view, it can be done in fine weather, with smooth water, by veering a boat (copper-fastened) astern with the compass. The ship is then to steer on different courses, (the boat always keeping her masts in one,) until the compasses of the ship and boat agree. If there be no difference between them on any point, the ship has no aberration. But whatever difference is found between them, on any point, 'that is the ship's aberration for *that* particular point, and must be added or subtracted, to correct the ship's course on *that* point, according to the true magnetic course of the boat : and, in like manner, the respective differences, found on the several points, are to be applied to each. On whatever point the courses of the boat and the ship agree, when her masts are in one, *that* is the ship's point of change. The result of observations made with the ship's head on *this* point will give the true variation of the compass : but, if observed on any other points, the error of variation will be according to the amount of aberration, or differences found on those points respectively, between the course of the ship and boat, and must be applied, *more* or *less*, as the case may require, to correct it. The variation may be observed either before or after this process, for finding the ship's point of change and aberration ; and, if amplitudes, or azimuths, are taken at different parts of the ship, the difference between the azimuth compass (wherever it may stand) and the compass the ship steers by, ought always to be taken, and applied in like manner, to obtain the *true* variation.

It would be a great benefit to navigation, if the bearings of remarkable headlands and other objects, on the coasts of different countries, were *correctly* taken, and inserted in published charts : for, a ship, able to approach near enough to take the transit-bearing of any two such objects, whose relative situations were exactly true, could thus know, at once, her *aberration*, on whatever course she was steering, (if the true variation was on the chart,) since it would be the difference between it and the true transit-bearing laid down on the chart ; taking into consideration, at the same time, the known variation. For instance, supposing a ship to be steering West by compass, along a coast where two remarkable objects are situated, true North or South of each other, and the variation laid down on the chart is 29° West. On setting these objects in one from the ship, they are found to bear, by compass, N. 24° E., making a difference of 5° for her aberration on the *west* point. So that, if she had now to steer a correct *magnetic* west course, it must be shaped W. 5° S. ; or, to make a *true* West course, W. 24° N., according to the variation of 29° West.

If, again, with her head N. by E., she finds the transit-bearing of the two objects to be N. 29° E. by compass, agreeing with that laid down on the chart ; according to the variation, then, *that* is the point of change, because there is no *aberration*.

Again, if in steering East by compass, she finds the transit-bearing of the two objects to be N. 34° E. by compass, the difference between it and that on the Chart, according to the variation, being 5° ; therefore, to shape a correct magnetic East course, she must steer E. 5° S. ; or, to make a true East course, E. 34° S.

Men of war, and, indeed, all ships, should, at every opportunity, try the aberration, and ascertain their points of change ; and, after it is found, the metallic matter ought not, in any quantity, to be removed.

Our object in giving the preceding Remarks and Extracts, is rather to promote than to satisfy inquiry. Those who wish to understand the subject more fully will, of course, consult the various publications upon it which have latterly appeared ; more particularly the volume of Mr. Bain, already noticed, and a subsequent work, by Peter Barlow, Esq. F.R.S. &c., entitled, "*An Essay on Magnetic Attractions, particularly as respects the deviation on shipboard, &c. with an easy practical method of observing the same in all parts of the world.*" Second Edition, London, 1824. The latter is strictly scientific, and describes a variety of interesting experiments, made under the sanction of Government, at Woolwich.

Woolwich. Among the more important results of these experiments is this, that "*the power of attraction in iron resides wholly on the surface, and is independent of the mass* : the conclusion drawn from this fact appears, however, to be that, the magnetic fluid requires a certain thickness of metal, exceeding one-thirtieth of an inch, in order effectually to develop itself, and to act with its maximum of effect ; a striking instance of the intimate analogy which subsists between the magnetic and electric fluids."* Mr. Barlow adds, "the analogy, however, after all, may be rather apparent than real : as it is not improbable that every particle of iron possesses the same power, but that the influence appertaining to the particles in the interior of the mass is intercepted by those particles which lie nearer to the surface."

Mr. Barlow, in a note, has said, "I cannot resist adding a note in this place, which may be thought of some importance. Upon my examining the compasses in store in Woolwich Dock-Yard, I could scarcely bring myself to believe that the instruments exhibited to me were those actually employed in his Majesty's vessels : the cards, bowls, needles, &c. seem all worthy of each other, equally clumsy and imperfect. It is true, I had been using the most delicate needles, and might view those shown me in the worst light ; but still that they are, generally speaking, wretchedly defective, I found to be the prevailing opinion of every one who knew any thing of the business : and it does appear to me very unaccountable that vessels of such immense value, and the safety of so many valuable lives, should be endangered by the employment of instruments that would have disgraced the arts as they stood at the beginning of the eighteenth century."†

In one of the letters of our friend Captain Livingston, we find the following remarks : —

"It is strange with what pertinacity many maintain that iron will not attract the needle of a compass, provided the iron is covered with wood, or puttied up. For my part, I am well convinced that many a fine ship has owed her loss to iron near the compass. It seems hardly credible, but it is nevertheless true, that I have seen more than one vessel with copper-nailed decks, and an iron-fastened binnacle !

"I have seen iron attract the compass-needle through a piece of plate-glass, and through two ship's slates."—A. L.

"M. Poisson, in a Memoir on the Theory of Magnetism, Paris, 1824, has shown that, if a magnetic needle be placed in the *interior of a hollow sphere of soft iron*, and so small as not to exert any sensible influence on the sphere, it will not be subject to any magnetic action, and will consequently *not exhibit any polarity* from the effect of the earth's magnetism, or from that of any other magnets placed without the hollow sphere."—*Journal of Science*, &c., No. XXXIV.

Mr. Walker has noticed that, unarmed vessels have a very great advantage over ships of war, &c., in being able to steer more correctly, because they are under no necessity whatever of having any iron near to their compasses. However, he adds, their binnacles ought to be so constructed, that their compasses may be at least two feet from the deck, which would prevent the nails from affecting the needle.

"But, on board ships of war, and all armed vessels, where there are great quantities of iron, it is hardly possible to account for all the different derangements of the magnetic polarity ; for it will be as variable as the different positions that a ship may be in, and in every part of the ship the compass will have a different variation from the true meridian."—*Walker's Appendix*, 195.

In his Essay, above mentioned, Mr. Barlow has developed another source of unsus-

* Another important result is, that, *in a certain plane, an iron ball seems to have no influence on the needle ; and that this plane is exactly, or very nearly, perpendicular to the direction of the dipping-needle.*

† See the opinion of Captain Flinders, on the same subject, page 470. Of these compasses we have been told, the needles were, for some years, pressed, or stamped, out of common sheet-steel, at Sheffield ; in order that his Majesty's ships might be supplied at a *cheap rate*. It is astonishing that needles of the common form and quality are not altogether exploded ; and that others, superior in every respect, are not in general use. See, upon this subject, Mr. Walker's Treatise on Magnetism, pages 50 to 53 ; and Mr. Downie's remarks, prefixed to his Sailing Directions for the Eastern Coast of Scotland. The *improper form* of the needle alone, independent of local attraction, may produce an error in a ship's course, amounting to 5 or 6 degrees.—EDIT.

Mr. Barlow's Report on the Compasses supplied to the Royal Navy, addressed to the Lords of the Admiralty, is given in the Nautical Magazine, October, 1837.

pected error, which he found in a land-compass, excellently constructed. The needle was 6 inches in length, of the bar form, and very powerful. It had remained for a time in a certain position; and, on trial, it was found that a part of the brass box itself had become sufficiently magnetic to produce a vibration of the needle, when applied outside the glass, of 14 or 15 degrees, and to retain the same $1\frac{1}{2}$ degree out of its natural direction. Every screw and detached piece in the instrument had acquired the same quality in some, though a less, degree, so that no dependence could be placed upon the needle, until they were all removed.—*Essay*, pp. 16, 17.

In 1820, Mr. Bywater wrote and published, at Liverpool, a Tract entitled, ‘*Observations on the Deviation of the Compass, with illustrative Remarks on its Magnetic Principles.*’ In this little work, the ingenious writer has clearly shown, from experiment, the effect of iron knees on the compass; and he proposes to relieve it from that influence by elevating it on a temporary ladder or stage, about twenty feet high, erected just before the mizen-mast. “To take,” he says, “advantage of this arrangement, a person should go up to inspect this compass every time the ship goes about, or whenever there is any suspicion that the ship’s compasses are influenced by the iron on board; and, from his report and comparison with the ship’s compasses, such remarks should be entered in the log-book, as will enable the sailing-master to make those allowances in the day’s work as shall exactly counteract this local attraction.” Testimonials of the utility of this mode of obtaining the true variation are added; the first of these by Mr. J. Williams, commander of the merchant-ship *Albion*, states that, on a voyage to and from New York, he found, by placing a compass about nine feet abaft the binnacle, and seven feet above the deck, that it was uninfluenced by the iron knees, &c. on board. Sometimes, according to the course of steering, it differed from the binnacle compass full one point, while at other times they agreed. Similar results were found by Mr. Neverson, another mercantile commander, on a voyage to and from the Island of St. Vincent. This simple mode of ascertaining the aberration of the needle on board, when other means are wanting, is, therefore, worthy of attention.*

Mr. Bywater has noticed the experiments on the magnetic properties of brass, formerly made by Mr. Cavallo; from which it appears that most brass becomes magnetic by hammering, but loses that quality by annealing or softening in fire.

MR. BARLOW’S CORRECTING PLATES FOR THE COMPASS.

“Since the action of any mass of iron, or system of iron bodies, may be referred to two points, indefinitely near to each other, in the general centre of attraction of such mass or system, it follows that, in a ship, all the action may be referred to a fixed point in the vessel, and that the line joining that point and the pivot of the needle will be fixed in position, as regards the ship, in all parts of the world; and, secondly, since the whole magnetic power of iron resides on its surface, it is easy to procure a plate of iron, of considerable weight, that shall have, when placed near the compass, an effect upon the needle equal to the great mass of iron in the vessel situated at a greater distance; and if, also, the centre of attraction in this plate be placed in the line above mentioned, then, in whatever direction the vessel is placed, or in whatever part of the world the observation may be made, the plate will always produce a disturbance on the needle equal to that of the ship; so that, by obtaining the one by observation, the other, that is the disturbance produced by the ship, becomes known. Hence, whatever may be the law by which this disturbing power is governed, or whatever may be the dip of the needle, or the direction of the ship’s head, the plate and the iron of the vessel attract the needle the same, both in quantity and direction, and the one becomes known by the observation made on the effect of the other.

“Upon

* In Part I. of the *Philosophical Transactions* of 1831, is a paper by Mr. Barlow, entitled, “On the Errors in the course of vessels, occasioned by local attraction; with some Remarks on the recent loss of H.M.S. *Thetis*, &c.” It would be superfluous to say that it is curious and interesting.

By way of illustration, among other examples, the author cites the case of H.M.S. *Gloicester*, in which the local attraction amounted to $9\frac{1}{2}$ degrees. That ship, in steering down the English Channel, was invariably drawn to the southward of her intended place; and it has been found, in cases of merchant-vessels, that, in steering down Channel, this effect is, at least, a quarter of a point. In the case of the *Gloicester*, we shall find that, after running ten miles, she would be more than a mile and a half to the southward of her reckoning; in a distance of 20 miles, three miles and a quarter to the southward; in 30 miles, five miles to the southward; and so on as the distance increases.

"Upon this principle, a circular plate of iron,* for counteracting the effect of aberration, has been contrived by Mr. Barlow. The proper situation for this plate, or neutralizing force, is to be found by experiment; and, in order to attain this situation, a place must first be selected for the azimuth or regulating compass to be fixed in, for observation during the period of the ship's being in commission. It will then be necessary to ascertain the local attraction of the vessel, which may be done in the following manner.

"The ship being moored, or lying with a short scope of cable, must have anchors so arranged as to admit of her head being directed to each point of the compass successively, and there steadied, whilst the bearing of a remote object is taken, (the more distant the better,) to avoid the parallax, which would otherwise affect the observations. It will then be found that the bearings, thus observed, differ from each other according to the attractive power of the vessel, from 6 or 8, to 26 or 28 degrees; a difference which is caused by the iron of the ship attracting the needle out of its proper direction, to the eastward with the ship's head to the East, and to the westward with the head to the West.

"On examining these several bearings, there will be found *two*, at opposite points of the compass, that will nearly agree with each other, the mean of which must be accounted the correct magnetic bearing of the object; and these points will also indicate the line of non-attraction in the vessel, and which will generally be found nearly fore and aft: in this line the plate is ultimately to be fixed.

"By comparing the correct magnetic bearing, as before found, with the observed bearing at the several points, the amount of the local attraction, at each point, will be ascertained.

"It now remains to determine the position of the plate in which it will correct the deviations. This will now be readily done by means of a small table, which Mr. Barlow intends to supply with every plate for that purpose. In this table will be found a variety of local attractions, comprehending all possible limits for every class of vessels, and in which will be found those of the vessel in question, corresponding to which will be found two numbers, one being the distance of the centre of the plate below the pivot of the needle; and the other its distance from the plumb-line passing through the same; at this depth and distance, in the line of non-attraction already mentioned, the plate must be fixed abaft the compass, in which position it will be found to correct those deviations caused by the great mass of iron lying before the compass; so that if the vessel is swung, no discrepancies will be found in the bearing of any object in this or any other part of the world."

The importance of this principle of correction has been amply demonstrated in several voyages. It is one of those valuable discoveries which have originated, not in mere chance, but from rigorous and scientific investigation; and it has been appreciated accordingly. The Board of Longitude has expressed its opinion by conferring on Mr. Barlow the largest premium (£500) allowed by the late longitude act; at the same time stating that this sum is not to be considered as any remuneration for the time and expenses bestowed upon the inquiry, which is recommended to be considered by the Navy and Admiralty Boards, as distinct from the above reward. The Honourable Board of Trinity-House has complimented the Professor with £200, and the East-India Board with a similar sum. Latterly, it has been announced that Admiral Krusenstern has written to Professor Barlow a very satisfactory and complimentary letter on the result of experiments with the Plate, made in a ship of the Imperial Navy at Cronstadt; and the Russian government, in consequence,

"Now," says Mr. Barlow, "it requires no knowledge of navigation to estimate the fatal consequences that might attend such an error in a narrow channel and in a dark night, if it were wholly unknown or disregarded."

In another discussion by Mr. Barlow, first given in the Philosophical Transactions of 1833, with a new general chart of the Lines of Variation, the author has more fully illustrated the subject, on which, as the chart, &c. now form a separate publication, it is needless to enlarge in this place.

By observations taken for local attraction on board H.M. surveying ship *Thunder*, at anchor in Funchal Roads, Madeira, with the northern extremity of the Great Deserta, 20 miles distant: correct bearing S. $57^{\circ} 30'$ E. by compass; with the ship's head either north or south, it corresponded within a degree; but with the ship's head, either east or west, the aberration amounted to $3^{\circ} 30'$ and $3^{\circ} 40'$; and on a N.E. and S.W. bearing to nearly 3° .

With the ship's head to the westward the westerly variation had increased, and with it thus it became requisite to add to the bearings in the 2d quadrant (between S. and E.) and to those of the 4th (between N. and W.) and subtract from those of the 3rd (between S. and W.) and from the 1st (or N.E.): and *vice versa*, with head to the eastward.—(Mr. Dunsterville.)

* Or several parallel plates screwed together.

has given orders for all its ships to be furnished with correcting compass-plates, similar to those fitted to the British ships. A valuable gold watch and rich dress chain has been presented to Mr. Barlow from the Emperor Alexander, as a mark of the Imperial approbation, and a deserved acknowledgment of his merit, &c.*

MR. POPE'S IMPROVED MARINER'S COMPASS.

This compass is the invention of Mr. William Pope, of Ball-alley, Lombard-street, London, and its peculiarity consists in suspending the needle in such a manner as to combine the advantages of the dipping-needle with those of the ordinary compass: the needle, from the mode in which it is suspended, being perfectly at liberty to *dip* in all latitudes, while the card retains its *horizontal position*.

Again, this compass increases its power of magnetic force where in others it diminishes, and that in every latitude from the equator to the poles; secondly, it retains its force even situated nearly over the polar point, where all others entirely lose it and become useless: thirdly, it is more steady on its point, a circumstance of the first importance when the agitation is increased by the motion of the vessel.

A complete description of the compass, with testimonials in its favour, by Dr. Birkbeck, and other scientific gentlemen, is given in No. 29, of the '*London Mechanic's Register*,' 7th May, 1825.

VIII.—ON THE GENERAL TEMPERATURE OF THE SEA; MARINE THERMOMETER; A THERMOMETRICAL JOURNAL, &c.

CAPTAIN HORSBURGH has said, "the temperature of the sea is a phenomenon of nature hitherto but little investigated, although it appears to be closely united with the improvement of nautical science: the following observations may, therefore, be not altogether unimportant to navigators.

"It has been thought that, the temperature of the ocean was subject to little mutability, particularly between the tropics; but the temperature of the surface of the ocean is affected by changes of the superincumbent atmosphere, as well as by other local or adventitious causes.

"1st, When the atmosphere is cold, a portion of its temperature is imparted to the surface of the ocean, by which the temperature of the latter is diminished; and, in calm settled weather, the maximum of temperature of the sea has been experienced about, on, or two hours after, mid-day, and the minimum about sun-rise in the morning.†

"2d, Tempestuous weather raises the temperature of the sea, which is probably produced from the agitation or friction of the broken waves, by the particles of water rubbing against each other.

"3d, *Currents have a more powerful influence than any other cause, in changing the temperature of the surface of the ocean*; so that, in either hemisphere, a current proceeding from the cold polar regions toward the equator, diminishes the temperature of the sea; whereas a current running from the inter-tropical regions, toward either pole, raises its temperature."

How long the great body of a current preserves its general temperature has been shown already in the description of the Gulf-Stream, and will be more clearly shown in a subsequent part of this section.

"4th and lastly, The depth of the sea appears also to have a great influence on the temperature of its surface; for the immense body of water contained in the ocean preserves its heat; whereas, in places of little depth, the surface of the water is cooled by the increased evaporation. The temperature of the ocean, therefore, ought to be higher than that of seas which have little depth of water, in the same parallels of latitude. This seems to be verified by the experiments and observations of Dr. Davy, during his voyage to Ceylon; as, in

* The Plate, with Instructions for its use, is sold by Messrs. W. and T. Gilbert, in London; and we presume that it will soon be obtainable at all the principal sea-ports.

† By the experiments and observations of Dr. John Davy, during a voyage to Ceylon.

approaching the land of Table Bay, at the Cape of Good-Hope, the temperature of the sea decreased 2° ; and it also decreased 2° , when the island of Ceylon was closely approached, although the bank of soundings does not extend far out from either of these places. Were the temperature of the sea, as well as that of the atmosphere, conjointly registered in the journals of navigators, several times during twenty-four hours, it would greatly assist the improvement of nautical science; and the proximity of land, or shoal-banks, might probably be ascertained, by carefully observing the temperature of the sea."

These remarks, by Captain Horsburgh, corroborate those already given in pages 210 to 222 of the preceding part of the present volume.

With respect to the temperature of the sea, at different depths, it seems reasonable enough to suppose that, in summer-time, it will be hotter at the surface than at any considerable depth below it, and that, in winter, it will be colder: this has been confirmed by many experiments.

Mr. Wales, who accompanied Captain Cook, has given the temperature of the sea as found in different depths and places. His apparatus, for trying the same, consisted of a square wooden tube, of about eighteen inches long, and three inches square externally. It was fitted with a valve at the bottom, and another at the top, "and had a contrivance for suspending the thermometer exactly in the middle of it. When it was used, it was fastened to the deep-sea line, just above the lead, so that all the way it descended, the water had a free passage through it, by means of the valves, which were then both open: but the instant it began to be drawn up, both the valves closed by the pressure of the water, and, of course, the thermometer was brought up, in a body of water of the same temperature, with that it was let down to." With this instrument, which is much the same with one formerly described by Mr. Boyle, in his observations on the saltness of the sea, water was fetched up from different depths, and its temperature accurately noticed in different seasons and latitudes. In the Ethiopic Ocean, Sept. 27th, 1772, in latitude $24^{\circ} 40'$ South, the heat of the air was $72\frac{1}{2}^{\circ}$, of the water of the surface, 70° ; but at the depth of 80 fathoms, it was 68° . Also, on December 27, 1772, in lat. $58^{\circ} 24'$ South, long. $27\frac{1}{2}^{\circ}$ East, the heat of the air was 31° , of the water, at the surface, 32° ; but, at the depth of 160 fathoms, $33\frac{1}{2}^{\circ}$.

In the voyage to Spitzbergen, 1773, Captain Phipps made use of a bottle to bring up water from the bottom, which is thus described: "The bottle had a coating of wool three inches thick, which was wrapped up in oil-skin, and let into a leather-purse, and the whole inclosed in a well-pitched canvas bag, firmly tied to the mouth of the bottle, so that not a drop of water could penetrate to its surface. A bit of lead, shaped like a cone, with its base downwards, and a cord fixed to its small end, was put in the bottle, and a piece of valve leather, with half a dozen slips of thin bladder, were strung on the cord, which, when pulled, effectually corked the bottle on the inside. We here describe two of the experiments which were made during that voyage.

"August 4th, 1773, in latitude $80^{\circ} 30'$ North, the heat of the air was 32° , of the water at the surface 36° , of water fetched up from the depth of 60 fathoms under the ice, 39° . September 4th, 1773, in latitude 65° North, the heat of the air was $66\frac{1}{2}^{\circ}$, of the water at the surface 55° , of water from the depth of 683 fathoms 40° . It therefore appears, from all these experiments, that, when the atmosphere was hotter than the surface of the sea, the superficial water was hotter than at a great depth; and, when the atmosphere was colder than the surface of the sea, it is evident that the superficial water was somewhat colder than at a considerable distance below it."

On the temperature of the sea, as found on the late expeditions to the North, the following remarks have been made. "A series of observations, on the temperature of the sea, at the surface and at certain depths, may serve to correct erroneous notions, which, it would appear, have prevailed on this subject. We have no doubt that they are the most accurate that have yet been made, and in deeper water than a self-registering thermometer had ever been sent down before in any part of the world. The result is very different from that of former observations. It seems that, in Baffin's Bay, the temperature, generally speaking, decreases with the depth. At 1005 fathoms, in lat. $71^{\circ} 24'$, the temperature was $8\frac{1}{2}^{\circ}$, at the surface, 36° ; and, whenever the depth exceeded 100 fathoms, the thermometer generally descended to 30° , or below, when 34 or 35 at the surface. Near Cape Walsingham, it is stated that, from the depth of 660 fathoms, the thermometer came up at $25\frac{1}{2}^{\circ}$; from 400, at 28° ; from 200, at 29° ; and from 100, at 30° ; the temperature of the air being 37° . It would be difficult to explain why the sea remained in the state of water at $25\frac{1}{2}^{\circ}$ of

Fahrenheit.

Fahrenheit. Did the pressure of the column of water prevent its freezing? or was the water more strongly impregnated with salt? These and other observations, made in the course of this voyage, both on land and sea, are completely at variance with the theory of isothermal lines of temperature, which had been assumed, as it would now appear, from a too-limited number of facts. But the most unaccountable circumstance is that of the Polar expedition having, in the seas of Spitzbergen, on the same parallels of latitude, invariably obtained a contrary result, the temperature of the sea increasing with the depth; so that, when the thermometer, at the surface, stood at 32° or 33° , at 300 fathoms it was 36° or 37° . We pretend not to explain this singular anomaly; indeed, we do not conceive that we are yet in possession of a sufficient number of facts to enable us to reason on the subject."—(*Quart. Rev.* No. XLI. May, 1819.)

The following experiments will prove that, between the tropics, and in the temperate zones, at sea, "when the temperature of the atmosphere exceeds that of the surface of the sea, the superficial water is *generally* warmer than at certain depths beneath it; (we say generally, because, in soundings and confined waters, local causes effect many exceptions to this general rule;) and, in all probability, the greater the depth, the colder the fluid in that case.

"On the 23d of February, 1804, off Falkland's Islands, in lat. 52° S., and about the longitude of 50° W., Admiral Krusenstern says, the temperature of the air was 59° , of the surface 55° ; and at the depth of 55 fathoms, 52° ; the whole depth at the time being 75 fathoms. On the 9th of March, 1804, beyond Cape Horn, in lat. $50^{\circ} 20'$ S., and long. $72^{\circ} 45'$ W., the temperature of the air was 41° ; the surface of the sea 39° : at the depth of 60 fathoms 38° ; and at 100 fathoms 36° . On the 24th of May, in the Pacific Ocean, 56 miles south of the equator, and in long. $146^{\circ} 16'$ W., the temperature of the air, and the surface of the sea, were equal, at 83° ; but that at the depth of 100 fathoms was 61° . On the 22d of June, in a perfect calm, on the tropic of Cancer, in the Pacific, the temperature of the surface of the sea was 78° ; at the depth of 25 fathoms, $76\frac{1}{2}^{\circ}$; at 50 fathoms, 71° ; and at 125 fathoms, 62° ; so that there was here a *progressive difference* of temperature of $2\frac{1}{2}^{\circ}$ at 25 fathoms, 7° at 50 fathoms, and 16° at 125 fathoms.* Many more examples might be given to the same effect, if it were necessary. A very remarkable one is mentioned by Mr. Abel Clarke, in his late work: he informs us that, "Captain Wauchope, of his Majesty's ship *Eurydice*, when within a few leagues of the equator, during a calm, put his apparatus overboard, and allowed it to descend till it had run about 1400 fathoms of line; but he estimated the perpendicular depth at 1000 fathoms. The temperature of the surface was 73° of Fahrenheit. On drawing up the instrument, he found the thermometer marking 42° ; a difference of temperature of 31° ." And there can be little doubt but that the difference of temperature was progressive, from the surface down to that depth.

It has already been observed, "that, in shallow seas, the cold substratum of liquid is brought nearer to the surface;" but though, as a general axiom, this may be true, yet it may not be relied on in particular cases. Some instances, in proof, may be collected from the journal of Captain Basil Hall, of the *Lyra*, from the Yellow Sea, 1816, who made some experiments on the temperature of the sea at the surface, at the Loochoo Islands, and in the Yellow Sea, &c.

On the 19th of July, when off Chusan,† in 32 fathoms of water, the temperature of the surface of the sea was 78° and 80° ; and on the 22d, in 43 fathoms, it was only 77° and 72° ; but, when at anchor in $3\frac{1}{2}$ fathoms, in the Gulf of Pechelee, in lat. $38^{\circ} 42'$, and long. $117^{\circ} 49'$ E., on the 27th of July, the temperature of the surface was as high as 82° . Also on the 3d of August, when at anchor off Pei-ho, the temperature of the surface was 82° at noon, and 80° at midnight, and *there* it was generally warmer than the atmosphere itself. When at anchor in Napakiang Harbour, the general temperature of the surface of the sea was about 83° ; but out at sea, off the Island Loochoo, when in lat. $26^{\circ} 36'$, and long. $127^{\circ} 56'$ E., the surface was 4 or 5 degrees *colder*; being, on the 14th and 15th, only $79\frac{1}{2}^{\circ}$ and 78° . Again, on the 20th of October, at anchor in Napakiang, when the autumnal cold had lowered the temperature of the sea's surface *there* to $75\frac{1}{2}^{\circ}$ and 75° , (or 7 and 8 degrees below what it was when anchored *there* before,) yet, in the Sea of Japan, the surface was also lower, being 74° and 73° .

* Adm. Krusenstern has given the temperature in the degrees of the scale of Reaumur; but we have reduced them to those of Fahrenheit, for the convenience of comparison, &c.—ED.

† In latitude $30^{\circ} 30'$ North; longitude about $124\frac{1}{2}$ East.

Thus, in these particular instances, the water became *warmer* (at least at the *surface*) the *nearer* the land was approached; and also as the depth of water *decreased*.

It will presently be seen, from the journal of Captain Livingston, that, *under similar local circumstances*, the water of the Gulf of Mexico, like that of the Yellow Sea, increases in heat toward its principal river; the one toward Mississippi, the other toward the Pei-ho. In the Mexican Gulf the heat of the sea was the greatest known; being at the temperature of 90° on the 30th of August, 1818; while that of the Yellow Sea was 82° on the 27th of July, 1816. The general principle, as to the Atlantic *Ocean*, is, however, incontrovertible.

Mr. Clarke has also published the result of a few experiments made by him on the temperature of the sea, in soundings both at the surface and bottom, which are highly useful and satisfactory. *They are shown in the following Table.*

No.	Date July 1816.	North Latitude.	East Longitude.	Depth in Fathoms.	Place.	Tempera- ture.			Difference of Tempe- rature		
						Air.	Surface.	Bottom.	Of the air and surface.	Of the surface and bottom.	Of the air and bottom.
1	23 : 8 A.M.	35° 10'	123° 40'	40	Open Sea.	76°	74°	65°	2°	9°	11°
2	24 : noon.	36° 24'	122° 59'	15	do.	75	71	67	4	4	8
3	25 : 8 A.M.	37° 30'	122° 40'	20	do.	72	67	62	5	5	10
4	8 P.M.	.....	.....	15	do.	74	69	66	5	3	8
5	26 : 6 A.M.	37° 58'	121° 34'	15	The Meetan Islands.	74	67	66	7	1	8
6	27 : 11 P.M.	38° 12'	120° 30'	15	G. of Pechelee.	75	74	72	1	2	3

From these experiments, (Mr. Clarke observes,) it appears, first, that the sea “diminishes in its temperature in proportion to its depth:” and second, “that the difference of the temperature of the surface, and any given depth, within a certain range, is *greater* at sea than near the land;” and third, “that the difference of the temperature at the surface and bottom is *greatest*, when that of the air and surface is least.”

The 1st and 3d positions appear evident on the face of the *experiments*; but the experiment No. 3, seems to affect the correctness of the 2d position, for the difference of the surface, and 20 fathoms depth, was 5°; and by that of the first experiment, made *farther* from the land, there was a difference of 9° *only* in 40 fathoms, which was proportionally less than *near* the land.

It is remarkable, however, that all these experiments (except the 3d) prove, as far as they go, that, in the depth of 15 fathoms, the water at the bottom was invariably *warmer* than it was found to be at the depth of 40 fathoms in the open sea; and in the Gulf of Pechelee, where the 6th experiment was made, it was no less than 7° *warmer* at the depth of 15 *fathoms*.

The lower state of the atmosphere, when the third experiment was made, would seem to account for the temperature of the water at the bottom being so much below what it was found to be by the others.

There is also a much larger proportional difference of the temperature of the air and water, at the depth of 20 fathoms, than there was by the rest of the experiments.

These experiments also prove that, “in these shallow seas, however, the cold sub-stratum of liquid *was not* brought *nearer* the surface,” at this season of the year. So that, in these instances, there was no “increasing coldness of water drawn up from the depth of only a few fathoms, to indicate to the navigator, who traverses the wide ocean, his approach to land or banks; but the very reverse.”—*Naval Chronicle*, Oct. 1818.

The Baron Humboldt has given the following statement, from numerous experiments

which he made between the 9th of June and 15th of July, 1799, on the *surface* of the Atlantic.

Latitude.	Longitude from Greenwich.	Temp. of Water.
39°10' N.	13°58' W.	59°
34 30 —	14 35 —	61
32 16 —	14 44 —	63
30 36 —	14 34 —	65
29 18 —	14 20 —	66½
26 51 —	16 53 —	68
20 8 —	26 31 —	70
17 57 —	30 54 —	72
14 57 —	42 20 —	74
13 51 —	47 23 —	76½
10 46 —	58 34 —	78

From Corunna to the mouth of the Tagus, the water of the sea varied but little in its temperature; but, from the 39th degree of latitude to the 10th, the increment was very sensible and very constant, though not always uniform. From the parallel of Cape Mondego to that of the Salvages, the progress of the thermometer was almost as rapid as from 20° 8' N. to 10° 46' : but it slackened extremely on the limits of the torrid zone, from 29° 18' to 20° 8'. This inequality is, no doubt, caused by the currents, which set on

one side of the ocean to the S.E., and on the other to the N.W. Don Cosmo de Churruca, who crossed the Equator in October, 1788, in the 23d degree of western longitude, found the greatest temperature of the water to be in the latitude of six degrees North.* In these parts, in latitudes equally distant from the equator, the water of the sea was colder to the south than the north.

From the equator to the 25th and 28th degrees of north latitude, the temperature is remarkably constant, notwithstanding the difference of meridians. It is more variable in the high latitudes, where the melting of the polar ice, and currents caused thereby, diminish the heat of the ocean. The following table, which contains experiments taken without discrimination from several nautical journals, confirm these assertions.

TABLE OF THE TEMPERATURE OF THE ATLANTIC OCEAN.

Latitude.	Longitude.	Temperature.	Time.	Observers.	Mean Temperature.
0°58' S.	25°14' W.	81°	Nov....1788	Churruca.	80½° (Cook.)
0 57 —	27 51 —	82	April ...1803	Quevedo.	
0 33 —	19 0 —	82	March ..1800	Perrins.	
0 11 N.	81 55 —	82½	Febr. ...1803	Humboldt.	
0 13 —	49 22 —	81	May ....1800	Perrins.	
25 15 —	18 16 —	68	June....1799	Humboldt.	69¾° (La Perouse and Dalrymple.)
25 29 —	37 34 —	70	April ...1803	Quevedo.	
25 49 —	24 0 —	69	March ..1800	Perrins.	
27 40 —	14 44 —	70	Jan. ....1768	Chappe.	
28 47 —	15 57 —	78	Oct. ....1788	Churruca.	
42 34 —	13 25 —	52	Febr. ...1800	Perrins.	54° (Cook and D'Entrecasteaux.)
43 17 —	29 7 —	60	May ....1803	Quevedo.	
43 58 —	10 47 —	60½	June....1799	Humboldt.	
44 58 —	32 27 —	54	Dec. ...1789	Williams.	
45 13 —	2 20 —	60	Nov....1776	Franklin.	
48 11 —	11 58 —	57½	June....1790	Williams.	

Baron Humboldt adds, "It is very remarkable that, notwithstanding the immensity of the ocean, and the rapidity of the currents, there is a great uniformity every where in the

* This, it may be observed, accords with the termination of the S.E. trade-winds to the northward of the equator; (see Table, page 96;) and there is no doubt that it is equally variable. Little argument is required to prove that the two fluids, air and water, and their modifications, winds and currents, are affected by similar impulses. A certain parallel to the north of the line may be considered as the equator of temperature between the ices of the northern and southern polar regions. —Ed.

In 37° N. and 10½° W., (off Cape St. Vincent,) on the 2d of May, 1833, the temperatures at the depths specified, while that of the air and surface-water was 63°, were, at one fathom, 62°; at 5 fathoms, 61°; at 20 fathoms, 60°; at 100 fathoms, 58°; at 250 fathoms, still 58°: the current running S. 38° E., 16 miles in the 24 hours.

greatest heat of the equinoctial seas. Don Cosmo de Churruca found it, in the Atlantic Ocean, at 83° ; Mr. Perrins, in 1804, at nearly the same; Mr. Rodman, in a voyage from Philadelphia to Batavia, $83\frac{1}{4}^{\circ}$; and M. Quevedo, $83\frac{1}{2}^{\circ}$. We must recollect that under the temperate zone, to the north of the parallel of 45° , the mean temperature of different years varies more than four degrees.

“The greatest heat of the sea, which is from 82 to 84 degrees, proves more than any other consideration that the ocean is, in general, warmer than the atmosphere with which it is in immediate contact; and of which the mean temperature, near the equator, is from 68 to $80\frac{1}{2}$ degrees.”—See, further, *Humboldt's Personal Narrative*, Engl. Tr., Vol. II. p. 68.

HEAT of the SEA in the WEST INDIES. (*Chiefly from the Journals of Mr. Dunsterville.*)

Greatest heat in the Mexican Sea, August, 1818, surface 90° . } Captain
Strait of Florida, September, 1818 ——— 86° . } Livingston.

Caribbean Sea, lat. $13^{\circ} 20'$, long. $64^{\circ} 38'$.—Surface, 85° ; at the depth of 240 fathoms, 48° , September.—Difference, 37° .

East of the Bahamas, lat. $22^{\circ} 32'$, long. $71^{\circ} 27'$.—Surface, 77° ; at 511 fathoms, 45° .

Near the south coast of Cuba.—Surface, 83° ; at 1000 fathoms, $45\frac{1}{2}^{\circ}$.—Difference, $37\frac{1}{2}^{\circ}$.

In the Windward Passage, lat. $19^{\circ} 32'$, long. $75^{\circ} 28'$.—Surface, 84° ; at 440 fathoms, 44° .

Near the Isle of Ruatan, July.—Surface, 84° ; at 386 fathoms, 43° .—Difference, 41° .

S.S.W. of St. Andrew's Isle.—Surface, 83° ; at 450 fathoms, 42° .—Difference, 41° .

Northward of the Mosquito Coast.—Surface, 83° ; at 314 fathoms, 46° , August.

Off the Mosquito shore, lat. $14^{\circ} 2'$, long. $81^{\circ} 2'$,— $86\frac{1}{2}^{\circ}$; at 500 fathoms, 43° .—Diff. $43\frac{1}{2}^{\circ}$.

—————, lat. $10^{\circ} 52'$, long. $83^{\circ} 9'$.—Surface, 83° ; at 780 fathoms, 41° , September.—Difference, 42° .

Off the N.E. part of the Mosquito Coast.—Surface 81° ; at 524 fathoms, 42° , July.

Off Cape Tiberon, Hayti.—Surface, 80° , at 1035 fathoms, 41° .—Difference, 39° .

Caribbean Sea, northward of Margarita.—Surface, 74° ; at 482 fathoms, 58° , February.
(*Colombian Navigator*, Vol. iii. p. 331.)*

REMARKS ON THE FALL OF TEMPERATURE in the Water, on approaching Soundings from the Deep Sea. By Lieut. John Evans, 1828.

On the 2d June, 1828, a strong gale from the S.W.: small *fucus natans*, or ‘Gulf-weed;’ the American *Larus*, or gull, with striped wings, and the *Procellaria pelagica*, or Stormy Petrel, called, by sailors, ‘Mother Carey's Chicken.’ At 8 a.m. the temperature of the water was 68° : heavy sea breaking over the vessel. At noon, the latitude, by observation, $41^{\circ} 23' N.$, and the longitude, by account, $51^{\circ} 39' W.$;† placing our position about a degree south of the Newfoundland Great Bank.

The simpiesometer stood at 30.06: thermometer, in the air, 70° , and the temperature of the water 62° . At 1 p.m., the air suddenly became very cold, and the colour of the water changed to green, with a low haze, like steam, resting on the surface; indicating soundings. Passed a quantity of fucus in line north and south. At 1 h. 30 m. tried for soundings with 60 fathoms line, no bottom: cold sensibly increasing. At 2 p.m. the temperature of the water had fallen to 58° ; altered the course from East to E.N.E. until 8 p.m., in hopes of striking soundings. At 4 p.m. foggy, the air 54° (fallen 16° since noon), and the water 52° (fallen 10°). At 8 p.m., air 52° , and water 48° (14° since noon): no soundings, with 70 fathoms of line. At midnight, air 54° , water 50° : at 2 a.m. (3d June) the air 62° , and the water 58° : at 8, air 64° , water 62° .

* In 1823, Captain Sabine found the temperature of the water, at a depth of 1000 fathoms, in latitude $20\frac{1}{2}^{\circ} N.$, and long. $83\frac{1}{2}^{\circ} W.$, near the junction of the Caribbean and Mexican Seas, to be 45.5° , that of the surface being 83° . He infers that, 100 or 200 fathoms more line, would have caused the thermometer to descend into water at its maximum of density, as depends on heat; this inference being on the presumption that the greatest density of salt-water occurs, as is the case in fresh-water, at several degrees above its freezing point.

† This longitude was an approximation to the true, verified soon after by lunar.

The deductions to be drawn from these observations are, that there appear to be deep sounding nearly a degree south of the Great Bank; that the transition from warm air and sea, to cold, is palpable on crossing this Bank: and it may be further observed, that, from a strong gale, the wind lessened so much as to become at one time light, and the sea considerably less turbulent.

The air felt so cold, and there was such a diminution in the temperature of the water, that the captain considered it as certain that ice of some description was near, but hid from view by the fog.

It will be seen, that the temperature of both the air and water gradually rose as we advanced to the eastward, and at 8, the next morning, the sea had regained the same degree of temperature that it had on the noon of the day before we reached the green water, but the air was still six degrees colder.

It has been frequently remarked by attentive voyagers, that the temperature of the water over banks of the ocean is colder than that of the air and of the deep sea. This, as I have shown above, was very remarkable on the southern extremity of the Great Bank of Newfoundland: the difference, however, of temperature between the deep sea, the air, and the water over banks, is not every where so palpably evident as on the Newfoundland Bank,* as the following remarks will exemplify:—

For several days before we made the Caribbean Islands, (which was on the 27th Feb.,) the temperature of the water had been uniformly at 77° , being from one to three degrees warmer than the atmosphere; the day, however, we arrived within the islands, the temperature of the water, instead of falling, rose one degree, that is, to 78° , whilst the air was 76° and 77° .

Note.—There are soundings off Nevis, and also on the Avis Banks, which we crossed. It must be observed that, many of the islands here, such as Guadaloupe, Nevis, St. Christopher's, &c. are volcanic lands, which may account for the rise of the water temperature. This is a cause, I have little doubt, which operates to produce a contrary effect to that generally experienced.

From the Grand Cayman† to the Catoche or Campeché Bank, the temperature of the water was 79° , the air varying from 77° to 80° .

On striking soundings in 27 fathoms, the thermometer in the water fell to $78\frac{3}{4}^{\circ}$: the next day, in 13 and 25 fathoms, it fell to 76° , and on our quitting the Bank it rose to 78° .

Note.—It may be remarked here, that, during a strong north, we found that the thermometer in the Sea of Mexico fell from 79° air, 78° water, to 73° air, and 75° water; a diminution of 6° in the air, and of 3° in the water; but at Vera Cruz, during a severe north, the temperature of the air fell, in seven hours, ten degrees: that is, from 79° to 69° ! It appears to me, therefore, that the circumstance of the temperature of the water falling, when unaccompanied with other indications, such as a change of colour, the presence of mollusca, &c., is not to be considered, invariably, as a proof of the approach to soundings, or the vicinity of a bank. The fall of the thermometer on the Campeché Bank, in the first instance, was so trifling, that unless strict attention had been paid, the circumstance might have escaped notice.

On reaching and sounding in 40 fathoms on the Dry Tortugas Bank, the 20th April, the air was 73° , and the water 74° . The day before (19th) it was the same (we were then on the outer edge of the bank): on the 18th, the water was 72° : on the 17th and 16th, it was 77° , and had not been lower than 76° since leaving Vera Cruz, so that there was a fall of three degrees from the deep sea to the soundings. Some cause, unknown, no doubt created the irregularity (that of its falling to 72° on the 18th) above noticed: we may, probably, have passed over a spit of the bank, or a detached bank, which occasioned the fall of temperature; the ground here, as on the Campeché Bank, being imperfectly known.

* The great difference between the temperature of the deep sea, south of the Bank, and the water over the Bank itself, has been attributed to the warmth of the Florida Stream, which flows to the southward of it.

† The colour of the water was of a very light blue all the way from the Cayman to Cape Antonio, indicating great depth.

Note.—It is worthy of observation, that, when we got into the Florida Stream, after sounding the Dry Tortugas, the thermometer rose from 74° to 75° , whilst the air was at 70° , the water being *quite warm*. The wind was variable from North to N.E., blowing fresh, and the colour of the sea an intense blue: we anchored in Havanna next morning.

On approaching soundings in the English Channel, the temperature of the air varied from 60° to 66° , (from 15th to 22d June,) and that of the water from 62° to 59° . On the 20th it was 62° , on the 21st 59° , and on the 22d, when we struck soundings in 75 fathoms, it was also 59° , being a fall of 3 degrees. I may add, that it is probable we were on deep sea-soundings on the 21st. The colour of the water, on the extremity of the Bank, gave no indication of approach to soundings.—JOHN EVANS, (a) Lieut. R. N.

TEMPERATURE of the GULF-STREAM, and of the OCEAN thence toward GIBRALTAR, from the Journal of Captain Andrew Livingston, in the *Asia*, June, July, Sept. and Oct. 1818.

Captain Livingston, in his passage from Havanna to the Missisipi, June 28 to July 1, 1818, in the ship *Asia*, passed over the edge of the Tortugas Bank on the 28th, and appears to have been much retarded by the current. Variation, this day, by amplitude, $6^{\circ} 33'$ E.; ship's head N.W. by W. At noon, lat. obs. $24^{\circ} 40'$, long. by obs. and acc. $83^{\circ} 52'$. Next day, at noon, the ship was in lat. $26^{\circ} 36'$, long. $85^{\circ} 23'$; and, on the 30th, at noon, in lat. $28^{\circ} 19'$, long. $87^{\circ} 5'$. On this day a bottle was thrown overboard, with a view to elucidate the effect of the waters of the Missisipi, including a note, requesting that an account of it, when found, might be transmitted to the Editor of this work, but which has not since been heard of. At 10 a.m. July 1, the ship had passed the Bar. The prevalent winds, during the passage, were mostly E.N.E. and N.E. by E. to N.E.

The *Asia* quitted the Missisipi on the 30th Aug. 1818; at 5 p.m. the thermometer stood at 90° in the water, when the Bar bore N. 62° W. 28 miles distant. At New Orleans it generally stood at 87° , $87\frac{1}{2}^{\circ}$, and sometimes 88° , in the water; and, in the air, shaded, during the month of August, it ranged from 85° to 96° .

The route of the ship to Gibraltar, from the 30th of August to the 22d of October, is indicated by the statement in the Table annexed, which exhibits the ship's place, either by account or observation, every day at noon, with the temperature of the air in the afternoon, midnight, and noon, of every twenty-four hours, and the corresponding temperature of the water: the contents of the latter columns have been selected from a much greater number of observations, in order to form a lucid statement, at one view.

The * in the first column indicates a note following the Table; † signifies latitude observed; \odot \odot longitude by lunar distances, &c.

Captain Livingston says, "The thermometers used for the temperature were carefully tried, proven to be excellent, and to correspond accurately with each other. These instruments, both for the air and water, had metal scales; as I found that those with wooden and ivory scales by no means so susceptible of temperature as those with metal. I also found that thermometers, enclosed within a wooden frame, with a glass-front, even when they had a metal scale, were not so susceptible as those which had the tubes themselves exposed. I found, also, at first, by experiments at New Orleans, that the mercury dropped so quickly, after being withdrawn from the water, that there was hardly time to read it off: to remedy this, I had a tin-case made, loaded with lead, by which I was enabled to have the thermometers sunk deeper in the water; and, by keeping nearly one-half of the instrument immersed in the water, while reading off, I obtained sufficient time for that purpose before the mercury began to fall.

"An oven-like heat was constant at New Orleans during my stay there, day and night; the thermometer was never below 85° when placed in the draught of our cabin-windows; where I remarked that, it was always as low as it was in the houses on shore: which may be readily credited when the effect of the deck-awnings is considered."—A. L.

Astronomic Time.	Ship's Place at Noon.		Temperature of the Air.			Temperature of the Water.			Remarks.
1818.	Latitude.	Longitude.	P.M. Mdnt. Nn.			P.M. Mdnt. Nn.			
Aug. 31	27° 45'N.†	88° 27'W.	86	84	89	86	86	86	In the Mexican Sea, or Gulf of Mexico.
Sept. 1	27 28 †	87 12	89	86	89	87	86	87	
2*	26 55 †	86 15	88	86	85	87½	87	88	
3	26 22 †	85 45	87	87½	88½	88	86	86	
4	25 51 †	85 22⊙ ☾	89	87	89	86	86	86	
5	25 17 †	85 6⊙ ☾	86	86	88	86	86	86	
6*	25 19 †	85 20⊙ ☾	86	85½	87	86	86	86	
7*	24 32 †	83 38	85	85	86	86	86	86	
8*	23 27 †	82 28⊙ ☾	86	86	87	86	86	86	In the Strait of Florida.
9	24 11 †	80 41	87	86	86	86	86	86	
10*	25 48 †	79 30	87	86	83	86	86	85	
11*	27 30 †	79 35	82	84	85	85½	85	85	
12*	28 43 †	79 23	85	82	85	84½	84	85	Between the parallels of Cape Canaveral and Cape Hatteras.
13	29 48	79 37	84	80	85½	84½	85	82½	
14	31 31 †	80 3	84	81	87	84	84	83	
15	32 52 †	78 15	84	80½	85	84	84	82½	
16*	33 44 †	76 3	85	78	83½	82	81	84	
17	35 52	73 4	85	80½	84	84	83	82½	
18	36 25 †	69 45	84½	80	81	82½	83	80	
19	36 37 †	67 39	81½	75½	78	77½	77	77½	On the Passage between Cape Hatteras and the Azores, or Western Islands.
20*	37 39	65 8	80	78	80	77	77	80	
21	38 56 †	62 20	77	74	82	82½	81	77	
22*	38 56 †	60 7⊙ ☾	78	74	82	78	77	78	
23	39 4 †	58 16⊙ ☾	84½	70	78	78	77	79	
24*	39 20 †	55 9⊙ ☾	77	72	77	79	76	77	
25*	39 24 †	51 16	75	68	73	79	76	76	
26	39 37 †	47 33⊙ ☾	74	72	80	77	76	77	
27	40 8 †	43 30	—	—	—	—	—	—	
28*	39 52 †	40 18	74	75	72	75	74	74	
29*	39 45 †	38 13	77	71	76	74½	74½	75	Azores, or Western Islands.
30*	39 46 †	34 54	76	74	75	74½	74½	73	
Oct. 1*	39 23 †	32 13	76	72	78	73	74	74	
2	38 58 †	28 54	78	72	76	74	73	73	
3*	38 12 †	26 57 D *	72½	70	73	73	70½	71½	
4*	{ Between Pico and St. Michaels }		75	68	78	71½	71	70½	
5	S. Side of St. Michael's.		76	66	76	71½	70	71	
6*	Ditto.		77	65	66	71	70	70	
7*	Road of Ponta del Gada.		—	—	—	70	70	70	
8	38 4	26 6	70	—	66	70	70	70	
9	38 6½ †	25 41½	79	65	68	70	72	70	Azores to the Straits' Mouth.
10	38 13½ †	25 28	78	64	—	70	71	71	
11*	38 9 †	22 45	74	74	70	71	71	70	
12*	38 14	20 57	68	64	70	71	69	70	
13*	38 16 †	17 43	68	68	74	70	70	69	
14	38 2 †	13 43	68	68	68	69	69	68	
15	38 5 †	10 45 D *	70	64	68	69	68	69	
16*	37 29	8 26	70	67	64	69	66	66	Straits' Mouth and Strait of Gibraltar.
17*	36 25 †	7 20 Land	64	60	67	69	61	69	
18*	35 48 †	7 0 D *	70	65	73	69	69	69	
19*	36 4 †	6 20 D *	76	65	73½	69½	69	65½	
20	43 44 †	5 49	67	66	64	65½	67	62	
21*	Strait of Gibraltar.		70	62	62	61	62	65½	
22	At anchor in Gibraltar Bay, by the Quarantine Cutter, in 3¾ fathoms.								

REMARKS,

REMARKS, &c., MADE ON THE PASSAGE.

Sept. 2.—At sun-set, variation of the compass, by amplitude, $6^{\circ} 49'$. (See page 62.) At 7 h., lat. by pole star, $27^{\circ} 21'$.

Sept. 6.—The ship appears to have been in an eddy current, which set during the first twelve hours of this day with considerable strength toward the N.W., and not in its expected south-easterly direction.

Sept. 7.—The ship had now advanced to the Tortugas' Bank, and the same southerly current which had so much retarded her on the 28th June, now facilitated her passage.

Sept. 8.—The easterly current does not appear to have assisted so soon as expected: it even seems as if the current, from about 4 p. m. yesterday, to 4 p. m. this day, had rather a westerly tendency.

Sept. 10.—At sun-set, variation, by amplitude, $5^{\circ} 49'$ East.

Sept. 11.—At 8 p. m., supposing the ship to be as close in to the Florida shore as was prudent, wore and tried the thermometer, which had sunk to 82° . In only a quarter of an hour afterward it rose to 85. Thus it had indicated an approach to the coast, and demonstrated its utility, even in the Strait of Florida.

Sept. 12.—This day the commander and several of the people fell sick, and continued thus more or less until the 20th, which prevented any more observations for longitude, &c. for several days.

Sept. 16.—This day the ship *Globe* of New York, passed. She sailed from the Balize four days and a half before the Asia, and, as she sails much better, the advance of the Asia was attributed to the pertinacity with which she strove, during baffling winds in the Gulf, to gain easting. It appeared by the thermometer this day, that the Asia was on the inner edge of the Gulf-Stream for the greater part of the 24 hours; but, when able to run off E.N.E., it became remarkable how the instrument immediately indicated the strong current.

Sept. 20.—P.M. the ship labouring, and making much leeway, shaped a course E.N.E. During these 24 hours fresh breezes from S.S.E., the latter part increasing to a gale, accompanied with small misly rain. The heat of the water, from eight a.m., seems to indicate that the ship is again under the influence of the Gulf-Stream, or more than in the preceding day, during which there appeared little influence of a current.

Sept. 22.—At sun-set, magnetic variation, by amplitude, $12^{\circ} 51'$ W. On the 24th the fluctuations of the mercury seemed to point out either warmer and colder veins of water, or the proximity of some unknown bank. On the 25th, magnetic variation by azimuth, $14^{\circ} 34'$ W.

Sept. 28.—At about 4 p. m. magnetic variation, by azimuth, $22^{\circ} 10'$, ship's head E.S.E., but a heavy sea was running, and the needle unsteady. On the 29th, magnetic variation, by azimuth, $21^{\circ} 32'$ W. On the 30th, a sudden decrease in the temperature of the water caused a sharp look-out for shoals, &c.

Oct. 1.—At about 4 p. m. magnetic variation, by mean of six azimuths, $22^{\circ} 7'$ W. A sudden fall of $1\frac{1}{2}^{\circ}$ in the temperature of the water at 8 p. m., might indicate a vigia, but it quickly rose again.

Oct. 3.—The thermometer, in the sea, fell as we approached Fayal, and continued at $70\frac{1}{2}$, until clear of the strait between Pico and St. George's, when it again began to rise. On the 4th, at about 5 a. m., the ship was apparently driving with a tide or current to the southward: took in studding-sails, and hauled by the wind. At 8 a. m., the west end of St. Michael's bore N. by E. $\frac{1}{2}$ E. distant about $2\frac{1}{2}$ leagues, magnetic variation, by azimuth, at 10h. 4m. a.m., $25^{\circ} 13'$ W., Ponta del Gada then bearing E.N.E. $\frac{1}{2}$ E., by compass, about 3 leagues.

Oct. 6.—Anchored in Ponta del Gada Roads, the cathedral bearing about N.E. by N., distant three-quarters of a mile: 17 fathoms of water, sandy bottom. In these roads the thermometer stood regularly at 70° in the water, when sunk to about 8 fathoms.

Oct.

Oct. 11.—At about 11 *a.m.*, (eastward of St. Michael's,) magnetic variation, by azimuth, $25^{\circ} 2'$. On the 12th, magnetic variation, by azimuth, at about 3h. 40m. *p.m.*, $24^{\circ} 59'$; at sun-set, by amplitude, $24^{\circ} 54'$: course E.S.E.: winds N.N.E., and variable. In the middle watch of this day an uncommonly heavy swell came on from the northward and westward, without any increase of wind; the ship rolling bulwarks under, first on one side, and then on the other.

Oct. 13.—Winds W.S.W. and West. The heavy swell went down as the breeze freshened.

Oct. 16.—About 4h. 45m. *p.m.*, magnetic variation, by azimuth, $21^{\circ} 48' W.$ On account of our nearing land caused the thermometer to be examined every two hours. At 8 *p.m.*, the thermometer, in the water, dropping to 66° , showed our approach to land, or at least to soundings. At day-light the water had assumed a greenish tint, in lieu of the deep blue of the ocean. At 8 *a.m.* sounded, but found no bottom with 90 fathoms.

Oct. 17.—At 2 *p.m.*, shaped a course to sight the land. Paid much attention to the thermometer. Afternoon very hazy, with small rain. At 6 *p.m.*, made the land, and the fog clearing off for a short time, saw the Monchique Mountains. Shaped a course to clear Cape St. Vincent. Observing the thermometer gradually and rapidly sinking, ordered every person to hearken for breakers, as well as look out for land, the fog being very close. At 10h. 30m., the haze clearing, saw Cape St. Vincent about a league and a half distant. A strong inset for some time seemed to drag us near the shore, notwithstanding the course we steered and way we made through the water. The observations of this day served particularly to show the utility of the thermometer. On the 18th, at sun-set, magnetic variation, by an excellent amplitude, $22^{\circ} 29' W.$

Oct. 19.—At sun-set, magnetic variation, by amplitude, $22^{\circ} 24' W.$ At noon, the tower on Cape Trafalgar bore E.N.E., distant about 6 leagues.

Oct. 21.—During the various tacks we have made in the Gut, it is remarkable with what precision the thermometer indicated our approach to either shore. At one *a.m.*, saw Tariffa Light bearing about East, by compass, distant about $3\frac{1}{2}$ leagues. Tacked ship as we approached either shore, as prudence dictated.—*A. L.*

IMPROVED MARINE THERMOMETER.

To the preceding remarks, Captain Livingston adds, "In my thermometric experiments I had several thermometers broken, and I have heard objections made to the experiments, that, in the manner they were made, the thermometer was not immersed far enough to enter into water sufficiently uninfluenced by the heat of the solar rays: but it will be seen, by comparing the day and night observations, that this is a futile objection. However, to avoid it, secure my thermometers from being broken, and to enable me to have a column of water round the thermometer, sufficient to retain its original temperature till such time as the degree indicated by the thermometer scale could be read off, keeping at the same time the bulb of the thermometer immersed in the water, I prevailed on an ingenious mechanic to attempt the structure of such a case as I wanted, in which he has most happily succeeded."

The person here alluded to is Mr. Robert Jamieson, a partner of the firm of Gardners, Jamieson, and Co., Mathematical Instrument Makers, in Glasgow, who has been honoured with the large silver medal of the Society for the Encouragement of Arts, as a public testimony of the value and utility of the invention.

DESCRIPTION.—The first figure, hereto annexed, represents the case, a tube of copper, which encloses a thermometer: the second figure represents a thermometer, so enclosed. The length of the whole tube, including the lid, is about 18 inches, and its external diameter 2 inches. The lid, which has a check to fit the tube, is about two inches deep, and has a conical or puppet valve in it, which rises upward. At the lower end of the tube is another valve of the same description, which, also, rises upward; and these two valves permit the water to pass freely through the tube while it descends in the water; but so soon as it stops, the valves shut, and the water admitted, at the greatest depth to which the machine is sunk, remains in the tube, around the thermometer.

Fig. I. is a back view of the case ready for use. In Fig. II. *aa* represents a ring, or collar, on which the thermometer-plate rests, to keep it clear of the lower valve: *bb*, the upper valve and valve-tube cover: *cc*, a bridge on which the neck, rod, or journal, of the valve works, through a hole in a swell in the centre of the bridge: *dd*, lower part of the journal, with a screw-head, which keeps it from rising through the hole in the bridge: *ee*, ends of the journals.

Mr. JAMIESON'S DIRECTIONS for the Use of the MACHINE are as follow :

In using the MARINE THERMOMETER-CASE, a stout line, of some fathoms in length, must be made fast to the handle of the case, which may be carried forward, and hove like the deep-sea lead. The length it must be passed forward will depend on the velocity with which the vessel, on board of which it is used, moves through the water; but a few experiments will show the intelligent observer what length of time is necessary to allow the mercury to rise or fall sufficiently, to indicate the true temperature of the sea. The observer must then haul up the case by the line, open the lid, and draw out the thermometer a sufficient length to allow of the altitude, as pointed out by the mercury in the thermometer-tube, being read off; but, in doing this, care should be taken always to keep the bulb of the thermometer immersed in the water contained in the case.

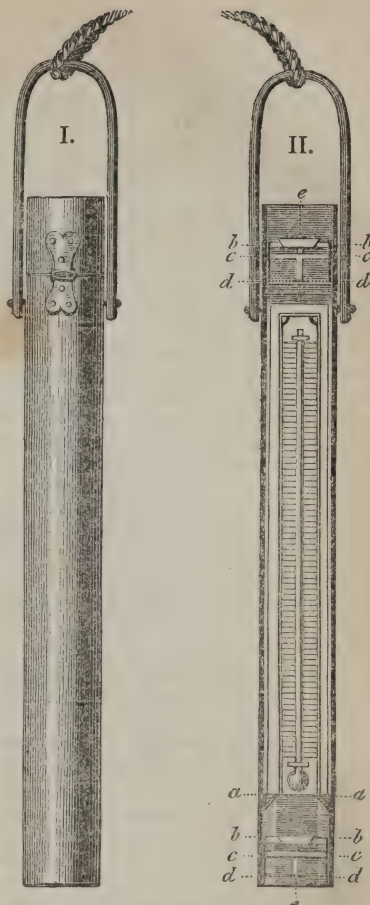
In practice, the case ought to be sunk as perpendicularly as possible, in order to insure the free passage of the water through it; and care must be taken never to permit it to touch the bottom, as sand, or other substances, might get in, and render the lower valve of no use till cleaned again.

The depth to which the instrument should be sunk must depend on various circumstances, but it is apprehended a few fathoms will generally be found sufficient. Probably it may be deep enough to sink the thermometer a foot or two lower than the ship's keel; but attentive observers will hardly fail to try it both at greater and lesser depths.

The frequent use of the thermometer is earnestly recommended; and it may be interesting, at the time when the observations are made on the heat of the sea, to note corresponding ones on the temperature of the air, though this is not essentially necessary.

Thermometric observations of the temperature of both the air and water may be taken every two hours; and, for convenience, two additional columns marked upon the log-slate; the one of which, denoting the temperature of the air, entitled T. A. at the top of the column, while T. W., at the head of the other, will denote the temperature of the water. From the log-slate these observations may be copied into a private journal, if not inserted in the ship's log-book.

We are happy to find that this instrument is generally approved; and, as its great utility is obvious, expect that it will be shortly in general use.



IX.—OF THE MARINE BAROMETER AND SIMPIESOMETER.

THE MARINE BAROMETER is an instrument too well known to require description. Captain Horsburgh says, "This is a very useful instrument in *high latitudes*, by assisting navigators to anticipate approaching storms. Previous to a hard gale of wind there is generally a great fall of the mercury, and, even *near the tropics*, the fall of it, before a storm or hurricane, is usually considerable. Within 9° or 10° of the Equator there seldom, or never, is a hurricane or storm of *long* duration; but whirlwinds and hard squalls, of a *few* hours' continuance, are sometimes experienced within these parallels of latitude without any fall of the mercury. Indeed the barometer is of little use as a guide in prognosticating storms which may happen within the tropics, except before a severe hurricane, when there is often a considerable fall of the mercury, the latitude being not less than 14° or 15° North or South.

"It is proper to observe that, in the open ocean, between the tropics, in settled weather, there is a *flux* and *reflux* in the atmosphere, twice every twenty-four hours, resembling the tides in the sea; but these atmospheric tides depend upon the sun's influence and the rotation of the earth, and do not follow the motion of the moon. The rise and fall of the mercury, in consequence of these tides, is about 6 or 7 of the hundred parts of an inch, in settled weather, near the equator; the high station happening about 11 o'clock in the morning, and 11 o'clock at night, and the low station about 5 o'clock in the morning and evening. The regularity of this flux and reflux of the atmosphere is *obstructed by land*, but, in the ocean, it prevails to latitude 26° North and South; and, in fine steady weather, it may be perceived as far as lat. 30° or 32° North and South. In high latitudes, the motion of the mercury in the barometer, like the winds, is mutable and uncertain; but, previous to a storm, or gale of wind, there is commonly a great fall, and the mercury begins to rise before the conclusion of the gale; sometimes even at its commencement, as the equilibrium in the atmosphere begins to be restored.

"Although the mercury sinks lowest before high winds, it frequently sinks considerably before a heavy fall of rain; and when the mercury stands low, the air is light, and deprived of expansibility or elasticity, therefore not capable of supporting much gaseous moisture; at such periods, consequently, rain generally falls. The mercury, also, sinks on the approach of thunder and lightning, or when the atmosphere is highly charged with electric matter.

"In serene settled weather, the mercury commonly stands high, also in clear frosty weather. The mercury, in the open sea, is in general inclined to rise with easterly, and fall with westerly, winds. It is likewise necessary to remember that, in the northern hemisphere, in the open sea, the mercury rises with northerly, and falls with southerly, winds; because the former, coming from the frozen parts, near the Pole, are more dense than the latter, which blow from the equatorial regions. In the southern hemisphere, the contrary takes place; for there the mercury rises with the cold southerly winds, and falls with northerly winds. These effects are more particularly observed in high latitudes, on the ocean; for obstructions and irregularities will always happen near land; because there the rarefaction and expansibility of the atmosphere are not so equal as over the ocean.

"After very warm and calm weather, in winter particularly, a storm is likely to follow; or at any time that the atmosphere is *greatly heated* above the medium temperature.

"By proper attention to the marine barometer, the experienced navigator may often be enabled to anticipate the changes of weather; and, in some seas, he may, by its indications, even take in or let out reefs in the night. It is also adviseable to observe the phases and progress of the moon; for it is reasonable to suppose that the influence of that planet upon the atmosphere must be considerable in penetrating through it to the surface of the ocean."

In brief, a change of weather seldom fails to be indicated by the least rising or falling of the mercury in the barometrical tube: the descent, in tropical latitudes, of an eighth of an inch, when at a distance from the land, is the unequivocal indication of an approaching storm. Many a ship has been saved from destruction by the timely notice given by this instrument to prepare for a storm, and *no ship should be permitted to go to sea without one.*

Dr. Arnott, in his excellent book, entitled, '*Elements of Natural Philosophy*,' has said, "To the husbandman the barometer is of considerable use, by aiding and correcting his prognostication of the weather drawn from local signs familiar to him; but its great use as
a weather-

a weather-glass seems to be to the mariner, who roams over the whole ocean, under skies and climates altogether new to him. The watchful captain of the present day, trusting to this extraordinary monitor, is often enabled to take in sail and to make ready for the storm, where, in former times, the dreadful visitation would have fallen upon him unprepared. The marine barometer has not yet been in general use for many years, and the author was one of a numerous crew who probably owed their preservation to its almost miraculous warning. It was in a southern latitude. The sun had just set with placid appearance, after a beautiful afternoon, and the usual mirth of the evening watch was proceeding, when the captain's order came to prepare with all haste for a storm. The barometer had begun to fall with appalling rapidity. As yet the old sailors had not perceived even a threatening in the sky, and they were surprised at the extent and hurry of the preparations; but the required measures were not completed, when a more awful hurricane burst upon them than the most experienced had ever braved. Nothing could withstand it; the sails, already furled and closely bound to the yards, were riven away in tatters; even the bare yards and masts were in great part disabled; and at one time the whole rigging had nearly fallen by the board. Such, for a few hours, was the mingled roar of the hurricane above, of the waves around, and of the incessant peals of thunder, that no human voice could be heard, and, amidst the general consternation, even the trumpet sounded in vain. In that awful night, but for the little tube of mercury which had given the warning, neither the extraordinary strength of the noble ship, nor the skill and energies of the commander, would have saved one man to tell the tale. On the following morning the wind was again at rest, but the ship lay upon the yet heaving waves an unsightly wreck."

Within the tropics, the fact of the barometer not being affected by any change in the atmosphere, except when under the influence of an approaching storm, is the very circumstance which more particularly enhances its value. In high latitudes the eye of an experienced seaman will prove a tolerably correct substitute for a barometer, but the tropical hurricane, unlike the storms of higher latitudes, frequently gives no other warning of its approach than that which the barometer affords. The practical inference from these premises is, that, whenever within the tropics an unusual fall of the barometrical column is observed to take place, it may be taken for granted that an extraordinary degree of the atmospheric rarefaction is in progress, which will be speedily followed by a violent re-action; and from that moment the ship may be said to have perforated the confines of a circle, the centre of which will shortly become the focus of a tornado.—(*Captain J. Marshall.*)

In the month of October, 1808, a remarkable and very destructive hurricane occurred in the Indian Ocean, as described in the '*Athenæum*,' No. 632, Dec. 7, 1839, and which is also noticed in Colonel Reid's volume, pp. 218-221.* Introductory to his description, Captain Marshall, of the *Diana*, in the Company's service, urges commanders to pay the most pointed attention to the indications of the marine barometer, which he says never fails, by the fall of the mercury, to indicate an approaching storm. The seaman is thus enabled, by bringing his ship to the wind, and other preparations, to secure to himself the best chance of escaping damage. "Even if, at the moment, the sky should be cloudless, the atmosphere motionless, and no other indication of a storm throughout the whole visible horizon, than that which this invaluable instrument affords him, still he will take his measures with the same degree of promptitude and energy as though the danger had already commenced; and when the flattering gale springs up to favour his course, he will not be tempted to pursue it through any fallacious notion of shortening the period of his voyage, for he may rest assured that the farther he advances the greater will be the fury of the tempest, and his easiest way to escape from its effects is to remain as stationary as possible. I should not have dwelt on some of these points had I not been aware that a notion is but too prevalent among seamen that scudding before the storm is the shortest way to get out of it; an error which is attended with this additional evil that those precious moments which intervene between the fall of the quicksilver and the rising of the storm are expended, (perhaps never to be retrieved) in a proceeding which, in my opinion, is fraught with nothing but mischief."

* The storm was first met, by the *Diana*, in 8° South and 88° E. Captain M. says, "It is impossible to convey to the minds of those who have never witnessed such a storm, any adequate idea of the fury with which it blew during the three days and nights of its continuance, the sound resembling more a succession of peals of thunder, or the roaring of cannon, than of wind; whilst the sea formed one continued breach over the ship, sweeping every thing moveable before it."

Of the nine ships, under convoy of the *Albion*, 74, from Madras, October 5, the *Glory*, *Lord Nelson*, and *Experiment*, foundered. See Colonel Reid on the "Law of Storms," pages 218-221.

CANARY ISLANDS.—“In no part of the world is the barometer more susceptible of atmospheric changes than amongst the Canary Islands. A rapid rise is the sure precursor of an easterly wind, whilst the contrary as certainly indicates a change to west or south-west. The easterly wind is accompanied by foggy or hazy weather; but clears immediately on changing in the least to the northward. When it blows strong from this quarter it is called by the fishermen a *brisa parda*. The temperature of the air is very equal: the average in December was 67° ; in January, 67° ; in February, 65° ; May, 69° ; August, 76° ; and it seldom varied more than four or five degrees in the twenty-four hours.”—(*Lieut. Arlett.*)

BAROMETER at the BAHAMA ISLANDS.—The following remarks on the Barometer, from observations made at NEW PROVIDENCE, during the years 1837 and 1838, are from those of the *Hon. J. C. Lees*, chief justice of Nassau.

The words ‘*fair, change, rain,*’ &c. marked on the plate of the instrument, are here of no use whatever; on the contrary, they tend to mislead.

The range of the mercury in the barometer, except in storms, is greater in the winter than in the summer months: in the West-Indies it neither rises nor falls to any thing like the extent to which it does in Europe, but the fluctuations, though small, are equally to be depended on.

Rain in this climate has but little effect on the barometer, which appears to be operated upon principally by the wind, rising or falling according to the direction from whence it blows. Thus the barometer will be much higher with winds from North to East, accompanied by rain, than when they blow from South to N.W. without rain.

The barometer rises highest when the wind is N.E., and falls lowest when it is N.W.

If during the winter months, or beginning of November to the end of March, the wind is steady at N.E., the barometer will stand at about 30 to 30.1 and 30.2; if then the weather becomes squally and the mercury *rises* much, (say one-tenth of an inch more,) it indicates, as far as I can judge from three instances, a gale or very stiff breeze from the same quarter: this is remarkable, for in all other cases of gales, the mercury falls. If with the wind at N.E. the mercury falls, the wind will become more easterly; if it continues to fall, it will go round to the S.E., South, and so on to the N.W., which will be its lowest point; in ordinary north-westers about 29.9; but if, instead of sinking thus gradually, it falls much, and suddenly with the wind at N.E., or at any intermediate point from that to South, the probability is that there will be a sudden lull, and the wind will fly round at once to the N.W.

If, however, after the mercury has been gradually falling, and at any of these intermediate points it rises again, the wind will, in that case, back to the East or N.E., and will continue there until the mercury has again fallen.

When the wind is at N.W., if the mercury continues low, the probability is that it will continue for some time at that point: but if it rises, it is a certain indication that the wind will go to the northward, and continue to rise to the N.E.; but if it falls with the wind at North, it will back again to the N.W.; if the rise with the wind at N.W. is much and rapid, the wind will not remain at North, but will go at once to the N.E.

During the summer months the winds vary from N.E. to South, the prevailing ones being between East and South; the barometer will, therefore, be found to fluctuate between about one tenth of an inch above, to one tenth below, 30 inches; being highest, as before stated, on the approach and during the continuance of N.E. winds; and lowest during or previous to southerly ones; but there is frequently a very light south wind in the mornings and evenings, extending but a small distance from the shore, which I take to be of the nature of the land-wind of the larger islands, and this wind does not seem to affect the barometer.

When, during the hurricane months, the barometer falls much and rapidly, preparations ought to be made for rough weather. Suppose, for instance, from standing at 30.2 it were to fall rapidly to 29.8, this ought to awaken suspicion; but if it were to fall one or two tenths more, there would be almost a certainty that a heavy gale would in a very short period follow: this fall of the barometer might be only an hour or half an hour before the hurricane; but a great deal might be done, for the security of vessels or houses, in that time.

The barometer, however, gave warning of adverse weather several hours previous to the destructive gale of the 27th of October, 1837. The 25th had been cloudy and squally, and

at nine o'clock at night the barometer fell to 29.72. Next morning the weather had become clear, but the mercury rose only five hundredths; at noon the sky was again overcast, the wind began to freshen from the S.E., and the barometer began again to fall. At 8 *p.m.* it was 29.7; that night the gale came on from about E.S.E. and continued to blow till next morning about seven o'clock, when it gradually ceased, and the gale was apparently at an end: but the mercury, which had continued to fall all night, and then stood at 28.87, sank with fearful rapidity to 28.5. I had a boat moored in the harbour, but not very securely; when, therefore, I observed the fall of the barometer, on the day previous to the gale, I had her better secured, which saved her from the effect of the S.E. gale during the night. When the gale was apparently at an end next morning, I was aware from the still greater fall of the mercury that it would soon blow harder than ever. I therefore had the boat as quickly as possible hauled up, which saved her from certain destruction; for, as will be remembered, in about an hour afterward the gale recommenced with tremendous fury from the N.W. At about ten o'clock the mercury began again to rise, and about three hours afterward the gale began to abate. At 9 *p.m.* it stood at 29.72, and from that time it continued gradually to rise as did the gale to moderate.

These observations are the result of only about two years' experience, a period too short to afford data for any certain conclusion on such subjects; it is very possible that circumstances may expand or condense the atmosphere, so as to occasion a rise or fall of the barometer, independently of the changes of the wind or the approach of a gale; or, on the other hand, that a gale might occur without a previous warning from the instrument. I can only, therefore, advise those who have a barometer, on the one hand never to despise its indications of a storm, because the weather appears fine; on the other never to neglect the precautions which an appearance of adverse weather would suggest, merely because the barometer had not fallen; it would be better to make unnecessary preparations ever so many times than to lose valuable property once from the want of them.—*Nautical Magazine*, Feb. 1839. Nassau, 12th July, 1838.

GULF and RIVER of ST. LAWRENCE.—*Captain Bayfield*, in his general remarks on the navigation of the *Gulf and River of St. Lawrence*, states that the barometer has here a range of from 29 to 30.5 inches during the navigable season, and its changes accompany those of the winds and weather with a considerable degree of constancy. The fluctuations of the barometric column are much greater and more frequent there than in lower latitudes; and sudden alterations, which in other climates would be alarming, may occur there without being followed by any corresponding change either in the wind or weather. But the navigator should not be inattentive to those minor changes, as a constant attention to the instrument can alone enable him to appreciate those decisive indications of the mercury which seldom or never prove deceptive.

“The following remarks will apply to those well-marked changes which usually indicate the approach of a gale of considerable strength, or of a shift of wind and weather; the correct anticipation of which is often of the utmost consequence to the safety of a vessel, as well as to the length of her voyage. When, after a continuance of westerly winds and fine weather, the barometer has risen nearly to its greatest height, say some tenths above 30 inches, or begins to fall a little, an easterly wind may be soon expected. If to this notice given by the barometer be added a warm hazy atmosphere during the day, and a heavy precipitation of dew at night, with very bright twinkling stars, or a coloured *aurora borealis*, the approach of an east wind is almost certain. If land be in sight at such a time, and appears much distorted by terrestrial refraction, or if vessels in sight have any relative proportions of their hull and sails changed by the *mirage*, or present double or treble images, such appearances will render the before probable indications of the barometer certain. At the commencement the easterly wind will probably be light, with fine clear weather, but this will not last above a few hours if the barometer continues to fall; on the contrary, the wind will gradually increase, and as it does so the sky will become overcast by degrees until it is completely clouded. Rain and fog will follow, and continue during the continuance of the easterly wind, with little intermission, until they are dissipated by a fresh breeze from the contrary quarter.

“If the fall of the barometer, during the continuance of the easterly wind, be very slow, the gale will probably continue and not be very violent: if rapid, it will probably be of short duration, and of greater strength: at any rate, when the mercury falls toward 29

* For Mr. Redfield's remarks on the barometer upon the coasts of the United States, see pages 263, 6.

inches, a change is certainly at hand, and the gale will, in general, come from the N.W. The strength of this succeeding gale will be in proportion to the fall of the barometer, and to the strength of the easterly gale which preceded it. In such a case, there is seldom many hours' interval between the one gale and the other. The east wind generally dies away to calm, and in a very few hours, or sometimes in much less time, the N.W. gale springs up. A heavy cross sea remains for some time from the previous gale.

"The barometer sometimes begins to rise in the interval of calm which precedes the N.W. gale; at others at its commencement: the fogs and rain cease, and the weather becomes quite clear, generally in a few hours, and sometimes almost immediately. The strength of the westerly gale is usually greatest soon after its commencement, and diminishes as the barometer rises, veering gradually to the West and S.W.

"It is worthy of remark that the circumstances just mentioned are exactly the reverse of those attending the easterly gale. The latter usually commences with clear weather and a high barometer, light at first from the South or S.E., and gradually increasing as it veers to the eastward, with a falling barometer.

"To return to the westerly gale;—If, after it has veered to S.W. and become moderate, the barometer remains steady at a moderate height, fine weather may be expected. If it remains at a considerable height, but still fluctuating and unsteady, within certain limits, variable, but not heavy, winds and variable weather may be expected. If, on the contrary, it rises quickly to a great height, a repetition of the easterly gale will not be improbable. We have experienced seasons in which the barometer may be said to have been no sooner blown up by one wind than it has been blown down by another, and this stormy alternation to have continued for several months, whilst in others we have had scarcely a double-reefed topsail breeze during the whole summer.

"There is, in fact, so great a difference in the phenomena of the weather in different seasons that it becomes very difficult to write any thing respecting it that shall not be liable to many exceptions. There are, however, some strongly marked cases of connexion between the indications of the barometer and changes of the winds and weather, which, within our experience of eight or nine years, have been subject to few, I might almost say no, exceptions. The first of these cases is that most common one, which I have endeavoured to describe, of an easterly gale, with a falling barometer, being always wet and foggy, and succeeded by a strong wind from the opposite quarter with a rising barometer. A second case, not of so frequent occurrence in common seasons, excepting in spring or early in summer, is the easterly wind with a rising barometer; which, although it may not be at first for a few hours, will almost always become fine and clear, and end in fine weather. A third case may be considered certain:—if the barometer fall suddenly and greatly, at any time, a northerly and most probably a N.W. gale, of great strength, may be confidently expected. It does not follow that will be immediate, for it may be preceded by a strong gale from S.W. for a few hours, during which the barometer will seldom rise, and even, probably, continue to fall, but when the S.W. gale dies away, the northerly or N.W. will soon succeed, with a rising barometer.

"In conclusion I may remark that as, on the one hand, a considerable fall of the barometer may occur, without being followed by a strong wind, so, on the other, a breeze of considerable strength may come on without any indication from the barometer: but not any thing that deserves the name of a gale. There has never, within our experience, occurred a gale so heavy as to be of serious consequence to a good vessel, the approach of which has not been indicated by the barometer. But it must be remembered that a high barometer, in this climate, and under the circumstances which I have mentioned, is often indicative of an easterly gale.

"It is remarkable that, in the Gulf and Estuary of St. Lawrence, a high barometer may be considered as the fore-runner of wet and foggy weather, which usually accompanies its fall: whilst a low barometer renders it equally probable that dry weather will ensue, since it often accompanies its rise. I am fully of opinion that the marine barometer is of the greatest assistance in the navigation of the Gulf and River of St. Lawrence, and that by attending constantly to its state and changes, with reference to the winds and weather which preceded them, combined with the indications afforded by the appearance of the sky, &c. those changes of the wind and weather, which are about to take place, may be anticipated with a degree of certainty sufficient, in most cases, to enable us to avoid being caught on a lee-shore, or in an unsafe anchorage, as well as to regulate our course in a voyage, in anticipation of the coming change."

The SIMPIESOMETER is an improved air-barometer, invented by Mr. Alexander Adie, F.R.S. Ed., who has given a description and figure of it in the *Edinburgh Philosophical Journal*, Vol. I. page 54. One of the first which was made was sent from the Clyde, in the ship *Buckinghamshire*, on her voyage to the East-Indies, 1816; and the following is the report given of the instrument, by the late Captain Christian, the commander, on his return.

"I am glad to say that I consider your barometer a valuable instrument at sea, having given it a fair trial on the outward passage to India, by keeping a correct register of it, as well as of the common Marine Barometer, taken every third hour, night and day, during the passage; and I not only found that it was fully as sensible of the changes of the atmosphere as the other barometer, but that it had a great advantage over all barometers I have ever seen used at sea, namely, that of not being, in the smallest degree, affected by the motion of the ship, which will often make the quicksilver in the common tube plunge, or rise and fall, in such a degree, as to make it very difficult to come within at least one or two tenths of an inch of the truth, even in the largest ships. On the passage home, I also found it very correct in the indication of the winds and weather."

Lieut. Wm. Robertson, who was on the Northern expedition of 1818, has said of it, "The Simpiesometer is a most excellent instrument, and shows the weather far better than the Marine Barometer. In short, the barometer is of no use compared to it. If it has any fault, it is that of being too sensible of small changes, which may frighten a reef in, when there is no occasion for it; but, taking it altogether, in my opinion, it surpasses the mercurial barometer as much as the barometer is superior to having none at all."

The Simpiesometer has also been tried on board the yacht of the Commissioners of Northern Lighthouses; and Mr. Stevenson, the engineer, has given his attestation of its superiority. Mr. Stevenson says that, "Having occasion, toward the conclusion of his voyage, in September, 1819, to visit the Isle of Man, he beheld the interesting spectacle of about 300 large fishing-boats, each from 15 to 20 tons burthen, leaving their various harbours at that island, in an apparently fine afternoon, and standing directly out to sea, with the intention of prosecuting the fishery under night. He, at the same time, remarked, that both the common marine barometer, and Adie's Simpiesometer, which were in the cabin of the vessel, indicated an approaching change of weather, the mercury falling to 29.5 inches. It became painful, therefore, to witness the scene: more than a thousand industrious fishermen, lulled to security by the fineness of the day, scattering their little barks over the face of the ocean, and thus rushing forward to imminent danger, or probable destruction. At sun-set, accordingly, the sky became cloudy and threatening; and, in the course of the night, it blew a very hard gale, which afterward continued for three days successively. This gale completely dispersed the fleet of boats, and it was not without the utmost difficulty that many of them reached the various creeks of the island. It is believed no lives were lost on this occasion; but the boats were damaged, much tackle was destroyed, and the men were unnecessarily exposed to danger and fatigue. During the same storm, it may be remarked, thirteen vessels were either totally lost or stranded, between the Isle of Anglesea and St. Bees' Head, in Lancashire. Mr. Stevenson remarks, how much it is to be regretted that the barometer is so little in use in the mercantile marine of Great Britain, compared with the trading vessels of Holland; and observes that, though the common marine barometer is perhaps too cumbersome for the ordinary run of fishing and coasting vessels, yet Adie's Simpiesometer is so extremely portable, that it might be carried even in a Manx boat. Each division of such vessels has a commodore, under whose orders the fleet sails: it would, therefore, be a most desirable thing that a Simpiesometer should be attached to each commodore's boat, from which a preconcerted signal of an expected gale, or change of weather, as indicated by the Simpiesometer, could easily be given."

X.—THE THERMOMETER, WITH SCALE OF TEMPERATURES.

Of the Instruments for measuring the increase and decrease of heat and cold, there are several sorts, but particularly those denominated the *Thermometers of Fahrenheit*, of *Reaumur*, and of the modern *French*. The first, which is deservedly preferred, and generally used, in England, is that of M. G. D. *Fahrenheit*, who was born at Hamburg, in 1686, and died in 1736: The second is that of M. *Reaumur*, an eminent French naturalist and member of the Academy of Sciences, who died in 1757: the last is that of the modern French mathematicians.

The Scale of Fahrenheit is that exhibited beneath. Reaumur's scale differs from it in having the space between the boiling and freezing points of water divided into eighty degrees only. On the latter, the new French scale is an improvement, it having the same space divided into 100°, and it is hence called the *centigrade* or *centesimal* scale. There is also another French scale, that of Delisle, divided into 150 degrees, thus approaching nearer to Fahrenheit, but not generally known.

At 600° of Fahrenheit, or the common scale, mercury boils.

546 oil of vitriol boils.

242 spirit of nitre boils.

213 cow's milk boils.

212 common fresh water boils ; 80° on Reaumur's Scale ; and 100° on the French Centesimal Scale.

190 brandy boils.

175 alcohol, or spirit of wine, boils.

156 serum of blood and white of eggs harden.

146 kills animals in a few minutes.

142 bees' wax melts.

112 spermaceti melts.

108 to 99, hens hatch eggs.

107 to 103, heat of the skin in ducks, geese, fowls, pigeons, partridges, &c.

106 heat of the skin in a common fever.

103 to 100, heat of the skin in cattle, sheep, dogs, cats, &c.

99 to 92, heat of the human blood in health.

97 heat of a swarm of bees.

84 sea-water, eastward of Cape Palmas, Africa, in May.

82½ mean temperature of the air at the Equator.

82 common heat of the sea near the Equator.

80 heat of the air, in the shade, in very hot weather.

75 to 72, temperature in which the pine-apple, cinnamon, rhubarb, &c., flourish.

74 butter begins to melt.

72 to 70, grapes, coffee, pimento, tamarinds, &c., flourish.

67 to 60, aloes, Indian fig (*cactus opuntia*), capers, &c., flourish.

64 heat of the air, in the shade, in warm weather.

60 mean temperature of the Bermudas in winter, or November to March.

55 mean temperature of the air in England.

50 mean temperature of the surface of the earth.

43 oil of olives begins to stiffen, or become opaque. Freezes at 36°.

40 Dew point of the hygrometer.

32 water just freezing, or snow and ice just melting. ZERO or 0 on Reaumur's, and on the French Centesimal Scale. Mean temperature at the North Cape.

30 milk freezes.

28 urine and common vinegar freeze.

20 wines, Burgundy, strong claret, and Madeira, freeze.

0 (Zero.) A mixture of snow and salt, which is able to freeze oil of tartar, but not brandy.

39 below 0, mercury or quicksilver freezes.

MEAN TEMPERATURE OF THE AIR IN DIFFERENT PLACES.

At Quebec Coldest month, 13.8° Hottest, 73.4°

New York 25.4 80.

Edinburgh 47.8 59.4

England [Jan. and July].... 38. 61.

Paris 36. 65.3

Rome 42.2 77.

Cairo [Kahira, in Egypt] 55.8 85.8

As connected with this subject, the indications of a change of weather, we annex a description of SQUALLS, from the work of the distinguished navigator to whom we are indebted for the leading paragraphs of the present section.

SQUALLS are generally of THREE kinds : that called the **ARCHED SQUALL** is frequently experienced, and usually rises up, from the horizon, in the form of an arch ; but, sometimes,

times, it assumes the appearance of a dense dark cloud, particularly when highly charged with rain or electric matter. From the time that the arch, or cloud, is first seen above the horizon, its motion is sometimes very quick to the zenith, the interval being scarcely sufficient to allow a ship to reduce the necessary sail before the wind reach her, which happens when the cloud has approached to the zenith. At other times the motion of the cloud is very slow, and not unfrequently it disappears, or is dispersed, the impulse of the wind being not then sufficient to reach a ship. As a general rule, it may be observed that, if there be rain in these squalls preceding the wind, the latter will probably follow the rain in sudden severe gusts: whereas, if the wind precedes the rain, the squalls are seldom so furious, and terminate in moderate showers of rain. This general rule, however, is often interrupted by the operation of local causes.

"The DESCENDING SQUALL is not so easily discerned as the former; because it issues from clouds which are formed in the lower parts of the atmosphere, near the observer; and when clouds are thus formed, they generally produce showers of rain, and successive squalls of wind.*

"The WHITE SQUALL is not often experienced; but it sometimes happens near to, or within, the tropics; particularly in the vicinity of mountainous land. This squall generally blows very violently for a short time; and, as it is liable to happen when the weather is clear, without any appearance in the atmosphere to indicate its approach, it is consequently very dangerous. The only mark that accompanies it, is the white broken water on the surface of the sea, which is torn up by the force of the wind.

"SQUALLS, and also storms, are sometimes progressive, at other times regressive, when obstructed by an opposite wind; or, according as the point of greatest rarefaction is situated.

"When a squall is opposed by an opposite wind, its motion is *greatly retarded thereby*; and a ship sometimes, in this case, out-runs the squall, and overtakes other ships which are within the limits of the opposite wind."

On the 12th of January 1832, H.M.S. *Beagle*, after visiting Tenerife, was proceeding toward the Cape Verde Islands, in about $20\frac{1}{2}^{\circ}$ N. and 21° W., when an unusual appearance was observed: "A cloud," says Captain Fitz-roy, "like a dense fog-bank, approached; and, as it drew near, the lower and darker part became arched, and rose rapidly, while under it was a white glare, which looked very suspicious. Sail was immediately reduced,—we expected a violent squall; but the cloud dispersed suddenly, and only a common fresh breeze came from the opposite quarter. Neither the sympiesometer nor the barometer had altered at all; but the cloud was so threatening that I put no trust in their indications, not being then so firm a believer in their prophetic movements as I am at present. Nevertheless I would by no means advocate the neglect of any precaution suggested by appearances of the weather, although no change should be foretold by the glasses. A mistake may be made by the observer, or a variation in the height of the column may have passed unheeded; while it is seldom that a practised eye can be deceived by the visible signs of an approaching squall or gale of wind.

"Undoubtedly the worst wind, next to a hurricane, which a vessel can encounter, is a violent '*White Squall*,' so called because it is accompanied by no cloud or peculiar appearance in the sky, and because of its tearing up the surface of the sea, and sweeping it along so as to make a white sheet of foam. By squalls of this description, frequent in the West Indies, and occasionally felt in other parts of the world, no notice will be given much above the horizon; but, by consulting a good barometer or sympiesometer, and frequently watching the surface of the sea itself, even a white squall may be guarded against in sufficient time.

"Dark clouds, hard mixed with soft, and inky fragments in rapid motion beneath them, accompanied perhaps by lightning and distant thunder, are the forerunners of a heavy squall. Soft shapeless clouds, in which it is impossible to point out a definite edge, usually bring rain, but not wind: and, generally speaking, the more distinctly defined the edges of clouds are, the more wind they foretell. A little attention to these simple observations, so familiar to persons who have been some time at sea, may save young officers unneces-

* In the Mexican Sea heavy and very sudden descending squalls come at times from very small clouds. These are scarcely felt until the cloud is almost right over the ship's masts.—A. L.

sary anxiety in one case, and prompt them to shorten sail at a proper time in the other."—(*Voyage*, Vol. II. 49.)

For the SQUALLS about the BERMUDA ISLES, see the note † page 416.

"Captain Reuben Bunker, an old and experienced seaman of Nantucket, has related that he has often, and sometimes for several days together, rode out a heavy gale at sea by furling all his sails, pointing his yards forward, and veering out from the bows a stream cable, with a small anchor and a spar lashed to it; thus riding, as at anchor, head to wind. He considered this mode much safer than scudding or lying-to; and in this situation, he said, his vessel seldom shipped any water.

"Mr. Owen, formerly master-attendant at Jamaica, recommended to schooners and other small vessels, when running before the wind in a gale, with a heavy sea following, to tow a hawser from the stern; as he had found, from experience, that it divided the waves, and prevented their breaking on board."—*Lieut. Evans*, "Revision of Geographic Terms," p. 134.

XI.—LIGHTNING-RODS AND CONDUCTORS, AS USED AT SEA.

Having given, in our preceding pages (134 to 137,) the description of a singular storm on the Florida Stream, which involves remarks on the utility of conductors of lightning at sea, we now append thereto some interesting comments on that subject by *Mr. Bywater*, of Liverpool, with additions by the Editor of the *Liverpool Commercial Chronicle*.

"So far back as March 10th, 1812, I wrote to the Editor of the *Liverpool Mercury*, on the best means of protecting seamen from the awful effects of lightning; and I then expressed some doubts whether the lightning or conducting-rods, which had been recommended by Dr. Franklin, could be applied to vessels at sea, with the same advantage as to buildings on shore—the ocean being but a bad conductor of the electric fluid when compared with the land.

"The correctness of this surmise has been clearly established by the testimony of Captain Bennett and others, on board the New York, to whom the greatest acknowledgments are due for their polite attention to so many inquiring visitors; for I have learnt from them, that when the vessel was struck the second time, the electric fluid descended the iron rod in a completely and perfectly visible stream, but recoiled from the surface of the water with so powerful a re-action, as to re-ascend the rod and burst with a lateral explosion, that seemed to envelope the whole ship in a flame of fire, which would not have been the case had the lower end of the conducting-rod come in contact with earth instead of water. Here then we have the clearest evidence, that conducting-rods do not give the same protection to a ship at sea as they do to a building on shore; and, in order to increase the usefulness of these rods, I would propose that there should be attached to the lower end of the rod, at the time of immediate danger, what I term a floating chain-conductor, about 100 feet long, which might be floated astern of the vessel by a small buoy or two. This would not only remove the point of re-action farther from the vessel, but it would give a more horizontal direction to the electric matter, and strongly dispose it to pass along the surface of the water; and if a few pointed wires were attached to the most distant buoy, they would also have a tendency to disperse the electric fluid into the air, and prevent that violent re-action, which, no doubt, in the case of the New York, melted the conducting-rod, and rendered it unfit for further service.

"After your correspondent has described the size of the conducting-rod, he remarks, that Dr. Franklin thought that a rod of similar strength would be sufficient to conduct the strongest charge of atmospheric electricity; but had the learned doctor been favoured with a detail of electric effects similar to those witnessed on board the New York, he most certainly would not have included marine conducting-rods in that calculation.

"Whether the plan I have so hastily sketched for your publication, is the best that can be devised for the end in view, I have not been very solicitous to ascertain; for, after the principle shall become generally known, commanders of vessels will be the most able persons to render it practically useful.

"I remain, Sir, yours most respectfully,

JOHN BYWATER.

"P.S.—To avoid expense and trouble, untarred rope might be attached to the lower end of

of the rod, instead of the chain I have mentioned, and if veered out several hundred yards, it would conduct the electric fluid away in a very effectual manner.

“*Liverpool, May 17, 1827.*”

“It may be well questioned whether, at the early period of experiment in electricity at which he wrote, Dr. Franklin had had an opportunity of observing any effects similar to those witnessed on board the New York. It would seem, from the statements of the persons on board, one of whom in particular had his attention fixed on the lightning-rod at the mast-head at the moment of its being struck, that the conductor perfectly well sustained the action of the stream of electric fluid in its descent, and that it only yielded to the power of the fluid in its return when repelled by the water, united with that of the still descending stream, this double force being so intense as to fuse the iron chain and scatter its disjointed fragments about the ship in such a degree of heat, as to cause instantaneous ignition wherever they alighted, notwithstanding the continued falling of a heavy shower of rain and hail, the latter lying in considerable thickness on the deck. That this proceeded from the recoil of the electric fluid from the water, appears from the flame being observed to re-ascend after reaching the water, and from portions of the conductor, which were afterwards found, exhibiting the eyes of the links, through which the rings that connected them were passed, indented to one-third of their thickness by the force of the concussion with which they were struck against each other while at a very high degree of heat. We have some recollection of hearing, in some experiments with an electrical machine, of a similar fusion of some thin wire, which had been used to join two parts of a chain-conductor that had been broken, by the fluid from the jar being overcharged.

“The giving way of the conductor was followed by a terrific explosion, of such violence as to force the ship bodily in a lateral direction, for a distance of several yards, while the whole of her masts and rigging appeared enveloped in a vivid flame, and a thick smoke or steam arose from the water. One of the most extraordinary consequences of this awful phenomenon is, the magnetising of every particle of metal which lay in the progress of the stream of the electric fluid which passed through the cabin. The works of the captain’s and passengers’ watches, the quadrant of the former, the wires of the piano-forte, the cabin knives and forks, the hoops of the main-mast, the chain-plates, bolts, and bands of the dead-eyes which secure the main-rigging on the starboard side, were all thus affected, in a very high degree.”—*Editor of the Chronicle.*

In the month of April, 1840, the *Chichester* revenue cutter, Captain Stuart, had her mast and part of the deck and bulwarks damaged by the lightning, in a storm on the coast of Galway. A ball of fire descended the mast and broke through the deck. The captain was sitting at dinner in his cabin, with his two daughters. The ball passed over the table, smashed the bulk-head, and shivered the dishes and glasses in pieces, but without injuring any one. The skylight was thrown up, and the whole of the deck in the centre of the vessel raised off the beams; all the patent lights were thrown out. The electric fluid passed through the bottom by the copper bolts, and tore off the copper sheathing opposite to them under water. The vessel was filled with smoke; the magnetism of the compasses was discharged; and those who had watches found they had stopped. The captain, after fishing the mast, &c. at length arrived at Greenock.

HARRIS’S LIGHTNING CONDUCTORS.—“To protect a ship effectually from damage by lightning, it is essential that the conductor be as continuous and as direct as possible, from the highest point to the sea; that it be permanently fixed in the masts, throughout their whole extent, so as to admit of the motion of one portion of the mast upon another; and that, in case of the removal of any part of the mast, together with the conductor attached to it, either from accident or design, the remaining portion should still be perfect, and equal to the transmission of an electrical discharge into the sea. To fulfil these conditions, pieces of sheet copper, from one-sixteenth to one-eighth of an inch thick, varying from one inch and a half to six inches in breadth, and being about two feet long, according to the size of the masts, are inserted into the masts in two laminæ, one over the other; the butts or joints of the one being covered by the central portions of the other. The laminæ are riveted together at the butts, so as to form a long, elastic, and continuous, line. The whole conductor is inserted under the edges of a neat groove, ploughed longitudinally in the aft side of the different masts, and secured in its position by wrought copper

copper nails, so as to present a fair surface. This metallic line then passes downward from the copper spindle at the mast-head, along the aft sides of the royal mast and top-gallant mast of large vessels, and is connected in its course with the copper about the sheave-holes. A copper lining in the aft side of the cap, through which the topmast slides, now takes up the connexion, and continues it over the cap to the aft side of the topmast, and so on, as before, to the step of the mast; here it meets a thick wide copper lining, turned round the cap, under the heel of the mast, and resting on a similar layer of copper, which is fixed to the keelson; this last is connected with some of the keelson bolts, and with three perpendicular bolts of copper, of two inches diameter, which are driven into the main keel upon three transverse or horizontal bolts brought into immediate contact with the copper expanded over the bottom. The laminæ of copper are turned over the respective mast-heads, and are secured about an inch or more down on the opposite side; the cap which corresponds is prepared in a somewhat similar way, the copper being continued from the lining in the aft part of the round-hole, over the cap, into the fore part of the square one, where it is turned down and secured as before, so that, when the cap is in its place, the contact is complete. In this way we have, under all circumstances, a continuous metallic line from the highest points to the sea, which will transmit the electric matter directly through the keel, and emit it into the non-conducting fluid, where it becomes perfectly neutralized and harmless.

A most interesting series of experiments, conducted by the inventor, *Mr. Wm. Snow Harris*, F.R.S. &c., at Plymouth, as well as before the Lords of the Admiralty, and subsequent trials on board of ships of war, have shown the decided superiority of this lightning conductor over that of the chain; the latter being subject to frequent disarrangement and fracture, as it has to be suspended from the masthead, and dragged through the water, and is always liable to entanglement upon the lowering of the upper masts, &c.

"Most satisfactory accounts have been received from his Majesty's ship *Dryad*, on the coast of Africa, of a trial of these conductors, in which their utility was manifested beyond a doubt. There had been a great deal of lightning on the coast, and in one instance the *Dryad* encountered the fury of a tornado. A heavy flash of lightning struck the foremast, which was seen distinctly to pass down the conductor; at the same time a whizzing noise was heard, resembling the boiling of water. In a short time after, a second flash was seen by the officers on the quarter-deck, to strike upon the mizen-mast, which passed off safely, but attended, as before, with a similar whizzing noise. It does not appear that the conductors sustained the slightest deterioration or marks from the passage of the electrical fluid.

This account from the *Dryad* goes to prove that the conductors do not, as may have been supposed, draw down upon a ship any dangerous consequences; or attract, as some persons imagine, more electric fluid than they can transmit. Of course, in the tornado mentioned above, there must necessarily have been plenty of electric fluid present to be attracted; so that either the conductors discharged the whole of it, or otherwise only as much as they attracted; if they discharged the whole, with so little effect, there surely can be nothing to apprehend. There can be no question but that the *Dryad*'s masts were saved by the rapidly equalizing power of the conductors, by which the dense and otherwise overwhelming stroke was passed. We have only to reflect on the frightful electrical action of a tornado on the coast of Africa, to conclude that the ship, enveloped (as she must have been) in electric matter, was entirely protected from damage by the influence of her lightning conductors.—*Hampshire Telegraph*, 23rd April, 1831.

Upon this subject a series of papers have been given in the *Nautical Magazine*, 1834. See the volume, pages 151, 225, 353, 402, 477, 739, 752, and 781, illustrated by a plan of the conductors.

The subject has since been continued in the volumes of the same important miscellany for the years 1835, 1837, 1838, 1839, and 1840.

Having recorded, in pages 136, 7, the destruction of the *Sir Walter Scott*, by lightning, 1835, we may here state, from a similar cause, that of the ship *Poland*, Captain Anthony, in 1840.

The *Poland* proceeded from New York with a cargo of cotton, at 11 a.m. on the 11th of May: the crew consisted of twenty steady and good men, besides the captain and two mates; there were 24 cabin passengers, male and female, with children, and 11 steerage passengers; altogether 63 persons. The weather was favourable until the 16th; and at noon of that day the ship was in lat. $41^{\circ} 35'$ and long. $58^{\circ} 30'$, on the northern border of the

the Gulf Stream. At two, *p.m.* it began to rain, showers and squalls till about three, followed by a severe shower which commenced with large drops. Most of the male passengers were in the house on deck, looking out at the rain and sea, the captain standing at the door, when a large ball of fire, apparently about twice the size of a man's hat, suddenly descended in an horizontal direction from the clouds, which appeared to be meeting from two different points of the compass a-head, and struck the larboard end of the foretopsail yard; it then descended by the ties or some chains to the end of the fore-yard, and ran on the yard to the cap of the fore-mast, where it exploded with a report similar to that of a cannon, and appeared like the explosion of a bomb, throwing out rays, in every direction, like those of the sun. The whole was instantaneous, and seen by several persons: it came and passed off in a flash, and was followed almost at the same instant by a peal of thunder, sharp and loud, but not long nor rumbling. It was the only flash or peal seen or heard.

Soon after it was ascertained that, when the ball exploded, the electric fluid ran down the fore-mast to the lower deck, where the chain cable was stowed, and it was found that the fluid had run round the chain, but there was no indication of its escape. On going into the fore-castle some signs of the lightning were seen, and it appeared, on a very close examination, that, after entering the steerage, it passed through into the fore-castle, and out by the companion way.

Although the cabin and steerage were filled with a sort of smoke, which had a sulphureous scent, no one supposed that the ship was on fire, which ultimately proved to be the case; and the work of discharging the cargo between decks, on the suggestion of the captain, went on cheerfully, amid a severe rain, until about 8 o'clock, when it appeared to be nearly extinguished; but at that time, when the fore lower hatch was reached, the awful fact appeared that the cotton in the lower hold was on fire. The hatch was immediately closed as tight as possible, the upper hatches were also closed and partially caulked and preparations made to get out the boats.

The long boat was launched overboard, and the women and children first handed over the side of the ship, but it was 10 o'clock before she was pushed off, and a line attached to her and the ship, having on board 35 persons. These, while the fire was silently burning, were two long nights and a day in the boat, but under such distressful circumstances, that they were at length glad to return on board.

Relief now seemed almost hopeless; but sail was made on the ship, and she stood to the N.E. An observation at noon, on the 18th, gave lat. $40^{\circ} 8'$, long. 56° . At about two *p.m.* on this day, a sail was discovered; signals of distress were made; and Captain Ingersoll (honored be his name!) of the *Clifton*, bound from Liverpool to New York, with 250 steerage passengers, saved the whole of the unfortunate sufferers from destruction. The ship, there is no doubt, sunk soon after.

Here could we justly eulogize the admirable conduct of Captain Anthony; but our object is to show the necessity of lightning conductors. The whole narrative, which is exceedingly affecting, was given in the London papers of June 27, 28, 1840.

XII.—CLASSIFICATION of the CLOUDS, as defined in the NOMENCLATURE of the celebrated Meteorologist Mr. LUKE HOWARD.

Our Naturalists on shore very frequently refer to the appearance of the sky according to the distinctions which have lately been established, but which, as yet, are very imperfectly understood by the generality of mariners, although sometimes introduced into the Journals of the more informed. We have, beyond expectation, exceeded our intended limits in the present volume, but we cannot resist the wish to make this portion of knowledge generally understood by those who traverse the ocean, and who may, at least, be amused daily by comparing the atmosphere with the following explanation.

The primary distinctions in the classification are,—1. The *Cirrus* or *Curl Cloud*, generally the most elevated of all the clouds, and the first light cloud that forms in the sky after fine clear weather. It is very light and delicate in its appearance; in constant motion, generally curling or waving, like feathers or extended fibres. 2. The *Stratus*, or *Fall Cloud*, is an extended sheet cloud, sometimes small, shapeless and undefined, like a creeping mist, and at other times covering a large portion of the earth; but it does not wet leaves or other substances. 3. The *Nimbus*, or *Rain Cloud*; an horizontal, heavy looking, and shapeless, cloud, from which rain is falling. Whatever shape a cloud may have retained previous to
rain

rain falling from it, at the moment of its change from vapour to water, it softens in appearance and becomes a *Nimbus*. 4, The *Cumulus* or *Stack Cloud*, which increases from below in dense convex and conical heaps; and is the grand prognostic and accompaniment of fair weather.

The *Cirrus* is often seen after a continuance of fine light weather, as a fine whitish line of cloud, stretched across the sky at a great height, the ends seeming lost in the horizon. This is often the first indication of a change to wet weather: to this line of *Cirrus* others are added laterally; and, at times, clouds of the same sort seem to proceed from the sides of the line, and are sent off in an oblique or transverse direction, so that the whole may have the appearance of net work.

At other times the lines of *Cirrus* become denser, descend lower in the atmosphere, and by uniting or conjoining with others below, produce rain. The line alluded to above is called the *Linear Cirrus*, and the transverse lines produce the *Reticulated* or *Curl Cloud*.

The *Comoid* or *Hairy Cirrus*, commonly called *Mare's Tail*, is the proper *Cirrus*; it resembles in appearance, a long lock of white hair, or a bunch of wool pulled out into fine pointed ends. The appearance of *Cirrus*, in the atmosphere, often indicates wind and rain; and when the fine tails have a constant direction toward any one point of the compass, it has been frequently observed that the gale has sprung up from that quarter to which they previously pointed.

The *Stratus* comprehends fogs, and all those creeping mists which in summer evenings fill the valleys, but disappear in the mornings. The best time for observing its formation is on a fine evening after a hot summer's day: we shall then observe that, as the *Cumuli* of the day decrease, a white mist forms near the ground; this cloud, as the *Cumuli* evaporate, by degrees arrives at its density. In autumn it remains longer in the morning. In winter it often puts on a still denser appearance, and remains during the day and even for many days successively.

The *Nimbus* always precedes a fall of snow, rain, or hail; and has received its name from a notion of the antients, who distinguished between the *Imber* or shower and the *Nimbus* or cloud from which the rain comes.

The *Cumulus* (plural *Cumuli*). The progressive formation of the *Cumulus* is seen in fine settled weather. If we then observe the sky soon after sun-rise, we shall see small clouds here and there, in the atmosphere, which appear to be the result of small gatherings, or concentrated parts of the evening mist, which, rising in the morning, grow into small masses of cloud, and the atmosphere becomes clear. As the sun rises these clouds become larger, by adjacent ones coalescing, and at length a large cloud is formed, assuming a cumulated irregular hemispherical shape: this usually subsides in the evening as it formed in the morning, breaking into small masses, then fragments, and evaporating, when it is succeeded by the *Stratus*, to the formation of which it may have contributed. In fine weather these clouds form soon after sun-rise, increase during the day, and subside with more regularity and have a more hemispherical form than in changeable weather. When well-formed *Cumuli* prevail for three or four days, the weather is settled. These *Cumuli* reflect a strong silvery light when opposed to the sun, like Alpine mountains covered with snow.

The *Secondary distinction of Clouds* partakes, in a mixed degree, of the preceding distinctions:—hence we have the *Cirro-cumulus*; the *Cirro-stratus*, and the *Cumulo-stratus*.

The *Cirro-cumulus* (cirrus and cumulus) is an assemblage of *nubeculæ*, or small roundish clouds, either detached from, or in contact with, each other, and frequently reaching, to appearance, into the azure sky, commonly attended by an increased temperature, and found to accord with a rising barometer. The most striking feature is observable in summer, before or about the time of thunder storms. The component *nubeculæ* are then very dense, round in form, and in closer apposition than usual. This kind of cloud is so commonly a forerunner of storms, that it has been assumed by some as a tempestuous prognostic. In rainy and variable weather, another variety of this cloud appears, contrasted very strikingly with that above mentioned; being of a light fleecy texture, without any regular form in its *nubeculæ*. Sometimes the latter are so small as scarcely to be discernible; but the sky seems speckled with innumerable little white transparent spots.

The *Cirro-cumulus* of fair summer weather is of a medium nature; not so dense as the stormy variety nor so light as the variable one. Its *nubeculæ* vary in size and proximity.

In fine dry weather, with light gales of north and easterly winds, small detachments rapidly form and subside again; generally in an horizontal arrangement.

When the Cirro-cumulus prevails we may anticipate an increase of temperature in summer; and in winter the breaking up of a frost, or warmer and wet weather. In the summer time, extensive beds of this cloud, viewed by moon-light, have a very beautiful appearance, which has been compared to a flock of sheep at rest. The Cirro-cumulus subsides either slowly, as if by evaporation, or changes into some other modification.

The *Cirro-stratus* (Cirrus and Stratus) or *Wane Cloud*, is composed of horizontal or slightly inclined masses of small clouds, attenuated toward a part or the whole of their exterior, bent downward or undulated, separate or in groupes, and generally, with a sinking barometer, indicating a decrease in temperature, with wind and rain or snow.

The Cirro-stratus is characterized by great horizontal extent in proportion to vertical breadth; so that when any other cloud begins to assume that form it generally ends in Cirro-stratus. The Cirrus more commonly becomes a Cirro-stratus than any other cloud: the Cirro-cumulus next; and then the Cumulus. The Cirro-stratus once formed sometimes resumes the modification from which it originated, but more frequently it gradually evaporates or conjoins with some other modification. It seldom remains long in one form, but seems to be constantly declining, and hence the term of *Wane Cloud*. It is sometimes composed of wavy bars or streaks, connected in the centre and confused, but the streaks more defined at the edges: this is common in variable weather in summer. The *Mackerel sky*, as it is termed, is a variety of this: another variety consists of one long and plain streak, thick in the middle and wasting away at its edges: and a third consisting of small rows of little clouds, curved in a peculiar manner, and a sure indication of stormy weather: this is more or less regularly formed, and the irregular formation is often produced when a large Cumulus passes under a long line of Cirro-stratus, and is also a sign of stormy weather.

The last variety of Cirro-stratus is a large shallow veil of cloud, which extensively over-spreads the sky, particularly in the evening and during the night; and through which the sun and moon appear dimly. It is in this cloud that those peculiar refractions of light, of the sun and moon, called *halos*, *mock suns*, &c. usually appear; and which is a tolerably certain prognostic of rain or snow. There are minor varieties which may frequently be observed.

The Cirro-stratus usually terminates in forming an intimate union with some other cloud, to produce rain; but at times it evaporates or changes into some other modification.

The *Cumulo-stratus* designates the Cirro-stratus blended with the Cumulus, and either appearing intermixed with heaps of the latter, or super-adding a wide structure to its base. The Cumulo-stratus is most frequent during a mean or changeable state of the barometer, when the wind blows from the west, with occasional deviations from the north and south.

This cloud may be always regarded as a preliminary to the production of rain; and it frequently forms in the following manner: the Cumulus which, in common, passes along in the current of the wind, seems retarded in its progress, increases its density, spreads out laterally, and at length overhangs the base, in dark and irregular protuberances. The change to the Cumulo-stratus often takes place at once in all the Cumuli which are near to each other; and their bases uniting, the superstructure rises up with mountain-like or rocky summits. The change from Cumulus to Cumulo-stratus is often preceded by Cirro-stratus.

Cumulo-strati vary in appearance; those in which hail showers and thunder storms form look extremely black before the change to rain, and have a menacing aspect, as they are seen coming slowly up with the wind. The Cumulo-stratus sometimes evaporates or changes again into Cumulus; but in general it ends in the Nimbus and fall of rain or snow: sometimes only one part forms a Nimbus, the other remaining a Cumulo-stratus.

GENERAL REMARK on the *Nimbus*.—Any of the modifications above described may increase so much as to obscure the sky without ending in rain; before which the peculiar characteristic of the rain cloud may always be distinguished. In order to get a clear idea of its formation you must observe a distant shower in profile, from its first formation to its fall in rain. You may then observe the Cumulus first arrested, then the Cirro-stratus or Cirrus may appear to alight on its top; the change to Cumulo-stratus then goes on rapidly, and this cloud, increasing in density, assumes that black and threatening appearance known as an indication of rain: presently this blackness is changed to a grey obscurity, and this is

the criterion of the actual formation of water, which now begins to fall, and constitutes the cloud a *Nimbus*, while a Cirriform crown of fibres extends from the upper part of the clouds, and small Cumuli enter into the lower part. After the shower has spent itself the cloud resumes its title of Cumulo-stratus, and thence probably changes into a different modification; and if Cumulo-strati appear again, they indicate a return of rain.

Captain Fitz-roy, in the Appendix to his Narrative of the voyage of the *Beagle*, has given three very beautiful plates, exhibiting the form of clouds, in accordance with the preceding definitions. To his explanation Capt. F. adds that the terms may be rendered more expressive by using the augmentative or diminutive terminations *onus* or *itus*, signifying in a greater or less degree, as *Cirronus*, (greater,) *ciritus*, (lesser), &c.

The terms may be abbreviated in journalizing by using the initial letters of each word, as *Ci.* for *Cirrus*; *C.* *Cumulus*; *Ci.C.* *Cirro-cumulus*; *N.* *Nimbus*; *S.* *Stratus*; *Ci.S.* *Cirro-stratus*; *C.S.* *Cumulo-stratus*, &c.

XIII.—MODE OF JOURNALIZING the WIND AND WEATHER, as prescribed by Captain Beaufort for H.M.S. *Beagle*, in 1831, and since ordained, generally, for the Royal Navy.

An Order addressed to all Captains and Commanding Officers of her Majesty's ships and vessels, dated Admiralty, Dec. 28th, 1838, states that the Lords Commissioners having had under consideration the general utility of recording, with clearness and precision, in the log-books, the actual state of the winds and weather, have thought fit to order that henceforward, in every page of the log-book, two columns shall be introduced, wherein the force of the wind and the appearance of the atmosphere shall be registered every hour, according to the scheme annexed; a copy of which is to be pasted into each book, and painted on the back of every log-board or log-slate: and two more columns to be given for the purpose of entering the heights of the barometer, or sympiesometer, and thermometer, when such instruments may be on board.

FIGURES TO DENOTE THE FORCE OF THE WIND.

A cypher, 0, denotes calm: figure 1, light air, just sufficient to give steerage way.

2, 3, and 4, *Breezes* with which a well-conditioned man of war, under all sail, and clean full, would go in smooth water; 2, *light breeze*, from one to two knots; 3, *gentle breeze*, 3 to 4 knots; 4, *moderate breeze*, 5 to 6 knots.

5 to 9, *fresh breeze to strong gale*; in which the same ship could just carry close hauled;—5, *fresh breeze*, royals, &c.; 6, *strong breeze*, single reefs and top-gallant sails; 7, *moderate gale*, double reefs, jib, &c.; 8, *fresh gale*, triple reefs, courses, &c.; 9, *strong gale*, close reefs and courses.

10, *Whole gale*, with which she could bear only close-reefed main topsail and reefed foresail: 11, *storm*, with which she would be reduced to storm staysails: 12, *hurricane*, to which she could show no canvas.

LETTERS TO DENOTE THE STATE OF THE WEATHER.

b, blue sky, whether with clear or hazy atmosphere.

c, cloudy; that is, detached opening clouds.

d, drizzling rain: f, fog; ff, thick fog.

g, gloomy dark weather; h, hail; l, lightning.

m, misty or hazy, so as to interrupt the view.

O, overcast; the whole sky being covered with one impervious cloud: p, passing showers: q, squally: r, rain, continuous: s, snow: t, thunder.

u, ugly threatening appearance in the weather: v, visibility of distant objects; sky cloudy or not: w, wet dew.

● (a black spot) under any letter, (or ◡) denotes an extraordinary degree.

EXAMPLES.

EXAMPLES.

- b, c, m, Blue sky, with detached opening clouds, but hazy round the horizon.
 g, v, Gloomy dark weather, but distant objects remarkably visible.
 q, p, d, l, t, Very hard squalls and drizzling showers, with lightning and very heavy thunder.
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MEMORANDUM, issued from the Colonial Office, London, September, 1839, on the RECORDS to be kept of the state of the WEATHER in the BRITISH COLONIES.

“The captains of ports, harbour-masters, and keepers of lighthouses; or, where those officers do not exist, some other competent public functionary, should be required to keep journals of the weather, on the principle of the log-books of ships.

“A column should be specially reserved for inserting the height of the barometer; and, under the head of ‘Remarks,’ should be entered all meteorological observations considered worthy of particular notice.

“When the keeper of a journal may hear that a vessel has encountered a storm, he will enter in it any information on the subject which he can rely on, together with the name of the ship, of her owner, and of the port to which she may belong.

“With the view of tracing the cause of storms, the Trinity Board of London have given directions for the adoption of measures to obtain a more accurate record of the weather than has hitherto been kept at the lighthouses of Great Britain and Ireland.

“The keepers of these lights having the opportunity of taking their observations by night as well as by day, great advantage may be derived from employing them in this manner. Officers in charge of colonial lighthouses should be instructed to keep similar journals. In noting the wind’s force both in the harbour-master’s journals and in the lighthouse reports, it is desirable that the officers should adopt the numbers for noting the strength of the wind now in use at Greenwich observatory, and about to be introduced at the lighthouses under the Trinity board.

“In the cases of St. Helena and Ascension it is desirable that more precise information should be obtained, by observation, respecting the ‘Rollers’ at those islands.* As the object of her Majesty’s government, in instituting these inquiries, is the advancement of knowledge in science generally, the governors of the several British colonies will consider how far it may be in their power to obtain useful information bearing on the subject from countries adjoining to their governments, in the possession of foreign powers, or how far it may be useful to the study of meteorology to exchange the observations made within their governments for those of other countries in the neighbourhood.

“If at any time desired, there would be no objection to the publication in the colonial newspapers of extracts from the journals.”

* See Remarks on Tides, pages 144, 145.

TABLE FOR CORRECTING THE SUN'S ALTITUDE, described on page 456.

Obs. Alt.	Height of the Eye above the Sea in Feet.															
	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36
5° 0'	3'.8	3'.5	3'.1	2'.8	2'.5	2'.3	2'.1	1'.8	1'.6	1'.4	1'.2	1'.0	0'.8	0'.6	0'.5	0'.3
5 20	4.3	4.0	3.6	3.3	3.1	2.8	2.6	2.3	2.1	1.9	1.7	1.5	1.3	1.1	1.0	0.8
5 40	4.8	4.5	4.1	3.8	3.5	3.3	3.1	2.8	2.6	2.4	2.2	2.0	1.8	1.6	1.5	1.3
5 0	5.3	4.9	4.6	4.3	4.0	3.7	3.5	3.3	3.0	2.8	2.6	2.4	2.2	2.1	1.9	1.7
6 20	5.7	5.4	5.0	4.7	4.4	4.1	3.9	3.7	3.3	3.2	3.0	2.8	2.6	2.5	2.3	2.0
6 40	6.0	5.7	5.3	5.0	4.7	4.5	4.3	4.0	3.8	3.6	3.4	3.2	3.0	2.8	2.7	2.3
7 0	6.4	6.0	5.7	5.4	5.1	4.8	4.6	4.4	4.1	3.9	3.7	3.5	3.3	3.2	3.0	2.7
7 20	6.7	6.3	6.0	5.7	5.4	5.1	4.9	4.7	4.4	4.2	4.0	3.8	3.6	3.5	3.3	3.1
7 40	6.9	6.6	6.2	5.9	5.7	5.4	5.2	4.9	4.7	4.5	4.3	4.1	3.9	3.8	3.6	3.4
8 0	7.2	6.8	6.5	6.2	5.9	5.7	5.4	5.2	5.0	4.8	4.6	4.4	4.2	4.0	3.9	3.7
8 20	7.5	7.1	6.7	6.5	6.2	5.9	5.7	5.5	5.2	5.0	4.8	4.6	4.4	4.3	4.1	3.9
8 40	7.7	7.3	7.0	6.7	6.4	6.1	5.9	5.7	5.5	5.2	5.0	4.8	4.7	4.5	4.3	4.1
9 0	7.9	7.5	7.2	6.9	6.6	6.4	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.5	4.4
9 20	8.1	7.7	7.4	7.1	6.8	6.6	6.3	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.6
9 40	8.3	7.9	7.6	7.3	7.0	6.7	6.5	6.3	6.1	5.8	5.6	5.4	5.3	5.1	4.9	4.7
10 0	8.5	8.1	7.8	7.5	7.2	6.9	6.7	6.5	6.2	6.0	5.8	5.6	5.4	5.3	5.1	4.9
10 30	8.7	8.3	8.0	7.7	7.4	7.2	6.9	6.7	6.5	6.3	6.1	5.9	5.7	5.5	5.4	5.2
11 0	8.9	8.6	8.2	7.9	7.6	7.4	7.2	6.9	6.7	6.5	6.3	6.1	5.9	5.7	5.6	5.4
11 30	9.1	8.8	8.4	8.1	7.8	7.6	7.4	7.1	6.9	6.7	6.5	6.3	6.1	5.9	5.8	5.6
12 0	9.3	9.0	8.6	8.3	8.0	7.8	7.6	7.3	7.1	6.9	6.7	6.5	6.3	6.2	6.0	5.8
13	9.6	9.3	9.0	8.7	8.4	8.1	7.9	7.7	7.4	7.2	7.0	6.8	6.6	6.5	6.3	6.1
14	9.9	9.6	9.2	8.9	8.7	8.4	8.2	7.9	7.7	7.5	7.3	7.1	6.9	6.8	6.6	6.4
15	10.2	9.8	9.5	9.2	8.9	8.7	8.4	8.2	8.0	7.8	7.6	7.4	7.2	7.0	6.9	6.7
16	10.4	10.1	9.7	9.4	9.1	8.9	8.7	8.4	8.2	8.0	7.8	7.6	7.4	7.2	7.1	6.9
17	10.6	10.3	9.9	9.6	9.3	9.1	8.9	8.6	8.3	8.2	8.0	7.8	7.6	7.4	7.3	7.1
18	10.8	10.4	10.1	9.8	9.5	9.3	9.0	8.8	8.6	8.4	8.2	8.0	7.8	7.6	7.5	7.3
19	11.0	10.6	10.3	10.0	9.7	9.4	9.2	9.0	8.8	8.5	8.3	8.1	8.0	7.8	7.6	7.4
20	11.1	10.7	10.4	10.1	9.8	9.6	9.3	9.1	8.9	8.7	8.5	8.2	8.1	7.9	7.7	7.6
21	11.2	10.9	10.5	10.2	10.0	9.7	9.5	9.2	9.0	8.8	8.6	8.4	8.2	8.1	7.9	7.7
22	11.4	11.0	10.7	10.4	10.1	9.8	9.6	9.4	9.1	8.9	8.7	8.5	8.3	8.2	8.0	7.8
23	11.5	11.1	10.8	10.5	10.2	9.9	9.7	9.5	9.2	9.0	8.8	8.6	8.4	8.3	8.1	7.9
24	11.6	11.2	10.9	10.6	10.3	10.0	9.8	9.6	9.3	9.1	8.9	8.7	8.5	8.4	8.2	8.0
25	11.7	11.3	11.0	10.7	10.4	10.1	9.9	9.7	9.4	9.2	9.0	8.8	8.6	8.5	8.3	8.1
26	11.7	11.4	11.0	10.7	10.5	10.2	10.0	9.7	9.5	9.3	9.1	8.9	8.7	8.6	8.4	8.2
27	11.8	11.5	11.1	10.8	10.5	10.3	10.1	9.8	9.6	9.4	9.2	9.0	8.8	8.6	8.5	8.3
28	11.9	11.6	11.2	10.9	10.6	10.4	10.2	9.9	9.7	9.5	9.3	9.1	8.9	8.7	8.5	8.4
30	12.0	11.7	11.3	11.0	10.8	10.5	10.3	10.0	9.8	9.6	9.4	9.2	9.0	8.9	8.7	8.5
32	12.2	11.8	11.5	11.2	10.9	10.6	10.4	10.2	9.9	9.7	9.5	9.3	9.1	9.0	8.8	8.6
34	12.3	11.9	11.6	11.3	11.0	10.7	10.5	10.3	10.1	9.9	9.6	9.4	9.2	9.1	8.9	8.7
36	12.4	12.0	11.7	11.4	11.1	10.8	10.6	10.4	10.2	9.9	9.7	9.5	9.3	9.2	9.0	8.8
38	12.5	12.1	11.8	11.5	11.2	10.9	10.7	10.5	10.2	10.0	9.8	9.6	9.4	9.3	9.1	8.9
40	12.5	12.2	11.8	11.5	11.3	11.0	10.8	10.5	10.3	10.1	9.9	9.7	9.5	9.4	9.2	9.0
42	12.6	12.2	11.9	11.6	11.3	11.1	10.8	10.6	10.4	10.2	10.0	9.8	9.6	9.4	9.3	9.1
44	12.7	12.3	12.0	11.7	11.4	11.1	10.9	10.7	10.5	10.2	10.1	9.8	9.7	9.5	9.3	9.1
46	12.7	12.4	12.0	11.7	11.5	11.2	11.0	10.7	10.5	10.3	10.2	9.9	9.7	9.6	9.4	9.2
48	12.8	12.4	12.1	11.8	11.5	11.3	11.0	10.8	10.6	10.4	10.2	10.0	9.8	9.6	9.5	9.3
50	12.8	12.5	12.2	11.9	11.6	11.3	11.1	10.9	10.6	10.4	10.3	10.0	9.8	9.7	9.5	9.3
52	12.9	12.5	12.2	11.9	11.6	11.4	11.1	10.9	10.7	10.5	10.3	10.1	9.9	9.7	9.6	9.4
54	13.0	12.6	12.3	12.0	11.7	11.4	11.2	11.0	10.7	10.5	10.3	10.1	9.9	9.8	9.6	9.4
56	13.0	12.6	12.3	12.0	11.7	11.5	11.2	11.0	10.8	10.6	10.4	10.2	10.0	9.8	9.7	9.5
58	13.0	12.7	12.3	12.0	11.7	11.5	11.3	11.0	10.8	10.6	10.4	10.2	10.0	9.9	9.7	9.5
60	13.1	12.7	12.4	12.1	11.8	11.6	11.3	11.1	10.9	10.6	10.4	10.2	10.1	9.9	9.7	9.5
62	13.1	12.8	12.4	12.1	11.8	11.6	11.4	11.1	10.9	10.7	10.5	10.3	10.1	9.9	9.8	9.6
64	13.2	12.8	12.5	12.2	11.9	11.6	11.4	11.2	10.9	10.7	10.5	10.3	10.1	10.0	9.8	9.6
66	13.2	12.8	12.5	12.2	11.9	11.7	11.4	11.2	11.0	10.8	10.6	10.4	10.2	10.0	9.8	9.7
70	13.3	12.9	12.6	12.3	12.0	11.8	11.5	11.3	11.0	10.8	10.6	10.4	10.2	10.1	9.9	9.7
80	13.4	13.1	12.7	12.4	12.1	11.9	11.7	11.4	11.2	11.0	10.8	10.6	10.4	10.2	10.1	9.9
90	13.6	13.2	12.9	12.6	12.3	12.0	11.8	11.6	11.3	11.1	10.9	10.7	10.5	10.4	10.2	10.0
Month,	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.				
Correction,	+0'.3	+0'.2	+0'.1	0'.0	-0'.2	-0'.2	-0'.2	-0'.2	-0'.1	+0'.1	+0'.2	+0'.3				







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